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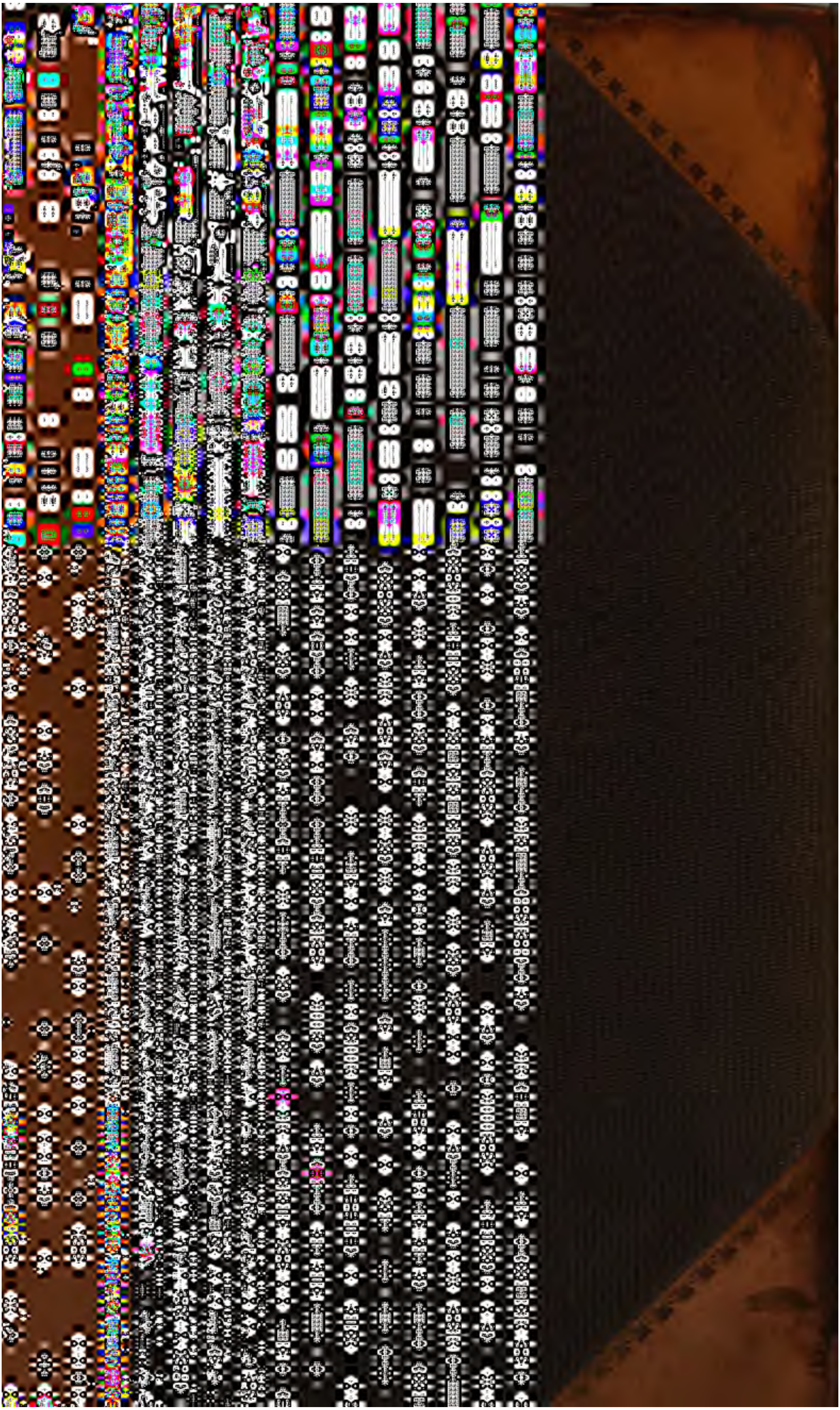

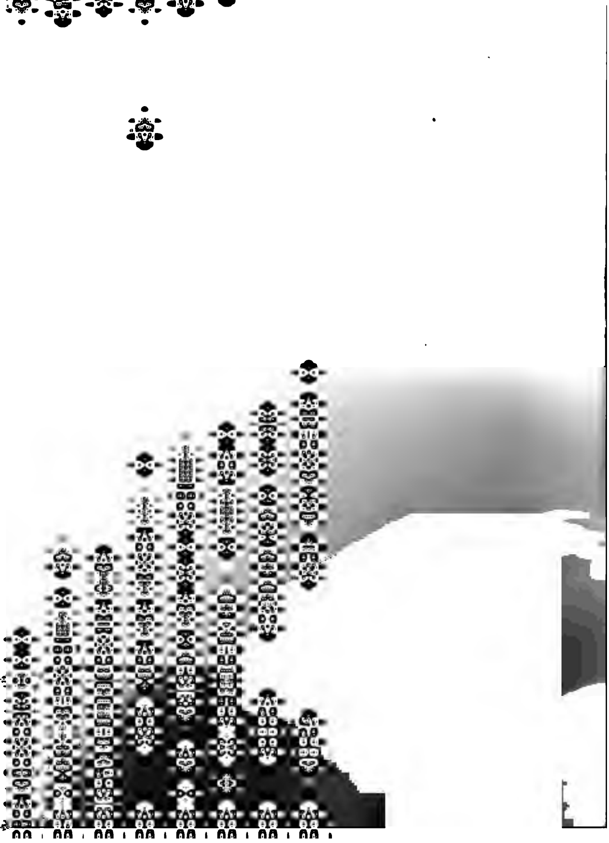

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

CHARLES C. BABINGTON, Esq., M.A., F.R.S., F.L.S., F.G.S.,
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AND
WILLIAM FRANCIS, Ph.D., F.L.S.

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M. 53.

"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—Linnæus.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—Bruckner, *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. Taylor, *Norwich*, 1818.

ALERE FLAMMAM.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

> "………………… per litora spargite muscum,
> Naiades, et circùm vitreos considite fontes:
> Pollice virgineo teneros hic carpite flores:
> Floribus et pictum, divæ, replete canistrum.
> At vos, o Nymphæ Craterides, ite sub undas;
> Ite, recurvato variata corallia trunco
> Vellite muscosis e rupibus, et mihi conchas
> Ferte, Deæ pelagi, et pingui conchylia succo."
>
> *N. Parthenii Giannettasii* Ecl. 1.

No. 55. JULY 1872.

I.—*Contributions to the Study of the Entomostraca.* By GEORGE STEWARDSON BRADY, C.M.Z.S. &c.

No. VII. *A List of the Non-parasitic Marine Copepoda of the North-east Coast of England.*

[Plates II.-VI.]

THE following list, though embracing all the species at present known to me as inhabiting the above-named district, must be taken only as an instalment of what an exhaustive survey would no doubt reveal. The examination of these little creatures is exceedingly tedious and laborious, the points of difference being often undistinguishable except with tolerably high microscopic powers. Thus a very small gathering, if it contain any great variety of species, will often occupy many hours in its examination.

By far the greater number of species here noted, or described by foreign authors, are free-swimming animals; some have a special predilection for the fronds of Fuci, and others for muddy localities or the bed of the sea; but little is yet known of the ground-inhabiting forms, and among them there remains doubtless a rich harvest for future collectors.

Two of the species described in Baird's 'British Entomostraca' it seems impossible to identify—*Canthocamptus Stromii* and *C. minuticornis*. The former name probably applies to some member of the genus *Thalestris*, the latter, perhaps, to a *Laophonte*. Neither species is included in the following list.

Fam. Calanidæ, Dana.

Subfam. *CALANINÆ*, Dana.

Genus CALANUS, Leach.

(*Cetochilus*, Roussel de Vauzème, *fide* Boeck.)

Calanus finmarchicus (Gunner).

Monoculus finmarchicus, Gunner, Act. Hafn. (1765), x. p. 175, f. 20–23.
Cetochilus septentrionalis, Goodsir, Edinb. New Phil. Journ. xxxv. p. 339, pl. 6. figs. 1–11; Baird, Nat. Hist. Brit. Entom. (1850), p. 335, t. 30. figs. 1, *a–g*.
Cetochilus helgolandicus, Claus, Die frei-leb. Copep. (1863), p. 171, t. 26. figs. 2–9.

According to M. Boeck the species described first by Gunner as *Monoculus finmarchicus* is identical with the *Cetochilus helgolandicus* of Claus, and not at all with the species called by Baird *Temora finmarchica*. Leach's genus *Calanus*, however, was constituted to receive Gunner's species, and is synonymous with the more recent name *Cetochilus*, applied by Roussel de Vauzème to the same animal. Not having the opportunity of reference to the original memoirs of Gunner and Leach, I must accept as substantially correct M. Boeck's careful account of this synonymy. The generic name *Cetochilus* must therefore give way to *Calanus*.

The present species, *C. finmarchicus*, is generally distributed all round the British coast, being met with in equal abundance both between tide-marks and in the open sea. It is said to constitute an important part of the food of the whale.

Genus CLAUSIA, Boeck.

Clausia elongata, Boeck.

Clausia elongata, Boeck, Oversigt Norges Copep. (1864), p. 10.
Calanus Clausii, Brady, Nat. Hist. Trans. N. & D. (1865), vol. i. p. 33, pl. 1. figs. 1–11, 13.

Often taken in abundance, by the surface-net, in the open sea and in tide-pools, all along our coast.

Boeck's *C. elongata* is undoubtedly the same species as that described by myself (possibly a little later, though I am not perfectly sure as to the actual date of publication of Boeck's monograph) under the name *Calanus Clausii*. The differences between this and the genus *Paracalanus*, Boeck (*Calanus*, Claus), lie chiefly in the one-jointed inner branch of the first foot, and in the very small or entirely wanting fifth foot of the female. It is, I think, open to doubt whether these ought to be considered of generic importance; but the separation having been made, it seems best to adhere to it.

Genus DIAS, Lilljeborg.

Dias longiremis, Lilljeborg.

Abundant all round the British Islands, both in the open sea and between tide-marks; frequent also in brackish water.

Genus TEMORA, Baird.

1. *Temora longicornis* (Müller).

Cyclops longicornis, Müller, Entomostraca (1785), p. 115, t. 19. figs. 7–9.
Temora finmarchica, Baird, Brit. Entom. (1850), p. 228, t. 28. figs. 1, *a–g*; Claus, Die frei-leb. Copep. p. 195, t. 34. figs. 1–11; Brady, Nat. Hist. Trans. N. & D. vol. i. p. 36, pl. 1. fig. 15, and pl. 2. figs. 1–10.
Temora longicornis, Boeck, *loc. cit.* p. 15.
Diaptomus longicaudatus, Lubbock.
(Not *Monoculus finmarchicus*, Gunner.)

Common in the open sea; and between tide-marks perhaps the most abundant of all British species.

2. *Temora velox*, Lilljeborg.

In the autumn months, when the brackish pools of salt marshes have become thoroughly warmed by the sun, this species occurs in such situations in immense profusion. I have only on one or two occasions met with a stray specimen amongst the weeds on the sea-shore.

Genus ISIAS, Boeck.

Isias clavipes, Boeck.

Isias clavipes, Boeck, *loc. cit.* p. 18.

Superior antennæ twenty-five-jointed, about equal in length to the cephalothorax; joints short and broad at the base, and gradually increasing in length to the nineteenth, which is about four times as long as broad; first fifteen joints of the male antennæ bearing each a single club-shaped, ciliated, auditory seta; hinge-joint of the twenty-one-jointed right male antenna situated between the eighteenth and nineteenth joints; eighteenth joint formed by the coalescence of the normal eighteenth and nineteenth; nineteenth by the twentieth and twenty-first; twentieth by the twenty-second, twenty-third, and twenty-fourth. Mouth-organs and swimming-feet as in *Centropages typicus*. Fifth pair of feet two-branched, in the *female* having the inner branch of one joint with two terminal setæ, the outer branch of three broad laminar joints, the second of which is produced on the inner margin into a broad spinous process: in the *male* the feet are somewhat similar, but the central joint is destitute of the spinous process, and the terminal joint of the outer branch of one side is expanded into a very broad lamina, which is terminated by a broad ciliated seta. Abdomen of the female with four, of the male with five segments. Length, exclusive of tail-setæ, $\frac{1}{17}$ of an inch.

Hab. Bridlington Bay; several specimens taken in the towing-net by Mr. E. C. Davison. On weeds in Roundstone and Clifden Bays, Ireland (*G. S. B.*).

The most distinguishing characters of this fine species are the auditory setæ, with which the upper antennæ are on their basal portions thickly clothed, and the broadly laminar construction of the fifth pair of feet, more especially in the male sex.

Genus Centropages, Kröyer.

(*Ichthyophorba*, Lilljeborg; *Calanopia*, Dana; *Catopia* (?), Dana.)

1. *Centropages typicus*, Kröyer.

C. typicus, Kröyer (1849), Nat. Tidsskr. Anden Række andet Bind, Side 288; Boeck (1864), Oversigt over de ved Norges Kyster iagttagne Copepoder, p. 19.

Ichthyophorba denticornis, Claus (1863), Die frei-lebenden Copepoden, p. 199, pl. 35. figs. 1, 3–9; Brady, Nat. Hist. Trans. N. & D. vol. i. p. 40, pl. 4. figs. 1–6.

This species occurs not uncommonly in surface-net gatherings from the open sea, but never in very great numbers, so far as my observation extends. I accept Boeck's identification of the species with *C. typicus* of Kröyer, but without the opportunity of myself referring for verification to the original description.

2. *Centropages hamatus* (Lilljeborg).

Ichthyophorba hamata, Lilljeborg (1853), De Crustaceis &c. p. 185, t. 21. figs. 1–5, 7–9, and t. 22. figs. 9–12; Brady, Nat. Hist. Trans. N. & D. (1865), vol. i. p. 39, pl. 4. figs. 7–10.

I. angustata, Claus (1863), Die frei-lebenden Copepoden, p. 199, t. 35. figs. 2, 10–12.

Diaptomus Bateanus, Lubbock (1857), Ann. & Mag. Nat. Hist. ser. 2. vol. xx. p. 404, pl. 11. figs. 1–3.

Centropages hamatus, Boeck (1864), Oversigt &c. p. 20.

Of very frequent occurrence in surface-net gatherings from the North Sea. I have also once taken it sparingly amongst Fuci near low-water mark, between Sunderland and Ryhope.

Subfam. *Pontellinæ.*

Genus Anomalocera, Templeton.

Anomalocera Patersonii, Temp.

Anomalocera Patersonii, Temp. Trans. Ent. Soc. (1837); Baird, Brit. Entom. (1850); Boeck, *loc. cit.* (1864).

Irenæus Patersonii, Claus, Die frei-leb. Copep. (1863).

Of common occurrence in the open sea all round the British Islands.

Genus PONTELLA, Dana.

Pontella brevicornis, Lubbock.

Pontella brevicornis, Lubbock, Ann. & Mag. Nat. Hist. ser. 2. vol. xx. (1857), pl. 11. figs. 4–8.

In surface-net off Grimsby and in Bridlington Bay. Amongst weeds in tide-pools near Ryhope, August 1871. Shetland (*Mr. Norman*).

In a gathering made by Mr. E. C. Davison in Bridlington Bay, this species occurred in great abundance, the contents of the net, which quite filled a six-ounce bottle, consisting of about equal numbers of *P. brevicornis*, *Anomalocera Patersonii*, and larval forms of the higher Decapods.

Fam. Cyclopidæ.

Genus CYCLOPS, O. F. Müller.

1. *Cyclops Lubbockii*, Brady.

C. Lubbockii, Brady, Nat. Hist. Trans. N. & D. vol. iv. p. 127, pl. 4. figs. 1–8.

In pools of brackish water, Hartlepool, June 1866.

2. *Cyclops æquoreus*, Fischer.

C. æquoreus, Fischer, Abhandl. der Akad. der Wissenschaften, München (1860), Band viii. p. 654; Brady, Nat. Hist. Trans. N. & D. vol. iv. p. 128, pl. iv. figs. 9–16.

In brackish pools at Seaton Sluice, Northumberland.

3. *Cyclops littoralis*, n. sp. Pl. II. figs. 9–14.

Superior antennæ twenty-two-jointed, clothed with long setæ, more particularly towards the base; joints all very short, the two terminal ones, which are the longest, not being much longer than broad, the twelfth and sixteenth much produced and bearing a long seta at the external margin. Inferior antennæ without a secondary branch, four-jointed; fifth pair of feet composed of a single three-jointed branch; caudal segments about four times as long as broad; setæ four, the two central ones being alike in length and equal to the three preceding segments.

Hab. Amongst weeds in tidal pools, near Whitley and Ryhope. Rare.

4. *Cyclops ovalis*, n. sp. Pl. III. figs. 1, 2.

Superior antennæ twenty-four-jointed, as long as cephalothorax, slender and nearly equal in width throughout; joints about equal in length and breadth at the base, gradually increasing in length towards the apex, the terminal joint being about thrice as long as broad; each joint bearing a single short delicate hair on the external margin, the twenty-second and twenty-third one on each margin, the last having four or five apical setæ. Caudal segments about four times as long as broad; setæ not much longer than the caudal segments.

Hab. One specimen only, taken off Sunderland in the surface-net.

Genus OITHONA, Baird.

Oithona helgolandica, Claus.

Oithona helgolandica, Claus (1863), Die frei-lebenden Copepoden, p. 105, Taf. 11. figs. 10–12.

O. spinifrons?, Boeck (1864), Oversigt Norges Copep. p. 25.

Taken occasionally in the surface-net; plentifully off Sunderland, August 1871. Frith of Forth, Whitby, and Bridlington, in gatherings made by Mr. E. C. Davison.

Boeck's description of *O. spinifrons* seems to me not to indicate any essential difference between it and *O. helgolandica*, Claus, the chief point being the presence of a minute rostrum in the Norwegian specimens, which is not noted in Claus's definition. This, however, might be easily overlooked. I have seen it in some of my examples, but have not succeeded in bringing it into view in others, and should, in fact, have probably missed it altogether, had it not been for M. Boeck's description.

Genus BOECKIA, nov. gen.

Like *Cyclopina* in general appearance. Superior antennæ very short, six-jointed, much shorter than the cephalothorax. (Mouth-organs totally different from those of any of the allied genera.) Swimming-feet like those of *Cyclops*, but very short and broad. Fifth pair of feet one-jointed, laminar, spinous. Abdomen much elongated; tail-setæ short; ovisacs two.

Boeckia arenicola, n. sp.

Second joint of superior antennæ the longest, three times as long as broad; fourth and fifth joints of equal length, two thirds as long as the second; sixth joint scarcely as long as the preceding; third the shortest of all, about one-fourth as long as the second. Inferior antennæ short and thick, three-jointed, without any secondary branch, densely beset with rather short and stout setæ. Swimming-feet having the marginal angles of the inner branch much produced; margins densely and finely ciliated; lateral spines of the outer branch lanceolate, laminar; the basal joint fringed with a row of somewhat similar, but much smaller, spines in pectinate series. Feet of fifth pair consisting of a single slightly curved, club-shaped joint, having on its outer margin one long spiniform seta with two minute ones near its base, at the truncate extremity two similar large setæ with an intermediate smaller one, on the middle of the inner margin six subequal curved setæ of moderate size, and at the extreme angle three of a similar kind but smaller. Abdomen elongated, swollen at the base; caudal segments rather more than twice as long as broad; tail-setæ shorter than the abdomen. Length $\frac{1}{18}$ of an inch.

One specimen, dredged on a sandy bottom at a depth of 4 fathoms, off Seaton Carew, September 1871.

The mouth-organs of this animal are of very remarkable structure; but I defer attempting any description or giving any drawing of this species, in the hope of being able to illustrate it completely from a better series of specimens.

Genus PSEUDOCYCLOPS, nov. gen.

In general conformation resembling *Cyclops*. Right superior antennæ of male without a hinge-joint, but much swollen in the middle. Inferior antennæ two-branched, secondary branch nearly equal in size to the primary. Lower foot-jaw like that of *Cyclops*. Swimming-feet having both branches three-jointed. Fifth pair of feet in the male very complex in structure, the external branch of one side produced into a powerful sickle-shaped clasping-joint, the whole resembling very closely the male copulative organs of some Ostracoda.

Pseudocyclops crassiremis, n. sp. Pl. II. figs. 1–8.

Left superior antenna of male seventeen-jointed; basal joint large and stout, those next following very short and broad, gradually decreasing in breadth to the fifteenth, which is about as long as broad; last two joints more slender, about twice as long as broad; the whole limb densely beset on the outer margin, especially towards the base, with long setæ; antenna of right side ten-jointed, the central joints much enlarged, last two suddenly contracted and similar to those of the left side, antepenultimate joint armed with a strong lateral subfalciform process; both branches of inferior antennæ bearing numerous long, curved terminal setæ; first joint of the lower branch enlarged and truncate at the distal end. Maxillæ composed of four digitate lobes, each bearing four long terminal setæ.

Lower foot-jaw stout, with almost entire margins. Joints of swimming-feet very broad, subtriangular, much produced at the external distal angle. Abdomen slender, consisting of four segments; tail-setæ slender, finely plumose, the longest equal to about twice the length of the abdomen. Length of animal $\frac{1}{38}$ of an inch.

Hab. Off Seaham Harbour, dredged in a depth of twenty to thirty fathoms. Only one specimen taken.

The characters of this genus are very remarkable and strongly pronounced, especially as regards the fifth pair of feet of the male, which are more complex than any thing of the kind hitherto known amongst the Copepoda. Another species referable to the same genus (*P. obtusatus*, Brady, MS.) was taken abundantly in the surface-net by Mr. D. Robertson and myself in Roundstone Bay, Ireland, on a calm moonlight night in June of last year.

Genus THORELLIA, Boeck.

Thorellia brunnea, Boeck.

T. brunnea, Boeck (1864), Oversigt over de ved Norges Kyster iagt. Copep. p. 26.

Cyclops nigricauda, Norman (1868), Last Shetland Dredging Report, p. 295.

One specimen of this species occurred to me amongst Fuci, in pools near low-water mark between Ryhope and Sunderland, in the autumn of 1871. Mr. Norman has taken it abundantly amongst *Laminariæ* in Shetland and at Tobermory in Mull.

The genus differs from *Cyclops* chiefly in the conformation of the lower foot-jaw, which is transformed into a four-jointed clawed foot. M. Boeck describes also in the same place another closely allied genus, *Misophria*, in which the maxillæ are formed as in the Harpactidæ, but with a strongly developed palp; the lower foot-jaws as in *Calanus*.

Genus CYCLOPICERA, nov. gen.

Superior antennæ about as long as the cephalothorax, many jointed, bearing (as in the Harpactidæ) a sword-shaped appendage near the distal extremity. Inferior antennæ three-jointed, having a minute secondary branch. Upper foot-jaw chelate, three-jointed, the last joint forming a doubly-curved very long claw; lower foot-jaw four-jointed, last two joints forming a long claw, each joint of which bears a spine on its inner margin. Swimming-feet as in *Cyclops*. Fifth pair of feet small, one-jointed.

Cyclopicera lata, n. sp. Pl. III. figs. 3–8.

Superior antennæ twenty-jointed, basal joint large, next eight very short and broad, the following six about as long as broad, sixteenth and seventeenth about twice as long as broad, last three shorter and more slender, seventeenth joint bearing a long laminated ensiform seta; inferior antennæ triarticulate, the first joint bearing a minute biciliated one-jointed branch, second joint of about equal length with the first, third very short and bearing a slender terminal claw; maxillæ two-branched (?), each branch terminating in three long slender setæ; fifth pair of feet very small, laminar, with one basal and two apical setæ. First segment of abdomen very short and broad, finely ciliated in the middle of each lateral margin; caudal segments about twice as long as broad; setæ equal in length to the abdomen.

One specimen only, taken amongst weeds in rock-pools at Roker.

Fam. **Corycæidæ.**

Genus MACROCHIRON*, nov. gen.

Superior antennæ (six to seven-?) jointed; inferior four-jointed, uncinate. Lower foot-jaw very large and powerfully chelate. First three pairs of swimming-feet alike, each branch being three-jointed; fourth pair with the inner branch small and two-jointed, rudimentary. Fifth segment of cephalothorax long and greatly swollen below. Abdomen consisting of five segments, all short.

Macrochiron fucicolum, n. sp. Pl. III. figs. 9–18.

Rostrum short, but distinctly angulated; first cephalothoracic segment very large, following three small, fifth constricted at the base but much swollen and elongated below, equal in length to the preceding three segments; abdominal segments short, none of them longer than broad, the first the shortest. Superior antennæ of the male seven- (?), of the female six-jointed; last joint of lower antenna very short, bearing several long setæ and a long curved claw, which is serrated on its inner margin; terminal claw of the lower foot-jaw very long and strong, suddenly curved at the extremity. First three pairs of swimming-feet short, springing from a large base, the joints short and broad; fourth pair having the outer branch elongated, the inner short, biarticulate, its second joint bearing two apical setæ. Fifth pair of feet rudimentary, slightly different in the two sexes. Caudal segments about

* Μακρὸς, long; χεὶρ, a hand.

thrice as long as broad; setæ short, ciliated, jointed in the middle. Length $\frac{1}{35}$ of an inch. Colour dark brown.

Hab. Amongst Fuci near low-water mark between Ryhope and Sunderland. Two or three specimens.

This approaches very closely the genera *Oncæa*, Philippi, and *Antaria*, Dana, but does not seem strictly referable to either of them. Probably, indeed, the two are synonymous. One of my specimens differed in some minor points from the others, whence I supposed it to be of different sex, and have so described it here. The species, however, requires further examination.

Fam. **Harpactidæ.**

Genus LONGIPEDIA, Claus.

Longipedia coronata, Claus.

This beautiful species occurred abundantly on a sandy bottom off Seaton Carew, in a depth of four fathoms, also off Seaham Harbour (twenty to thirty fathoms), and among weeds near the Bell-Rock Lighthouse. Mr. Norman finds it in Shetland; and I have myself taken it on the west coast of Ireland.

Genus ECTINOSOMA, Boeck.

Ectinosoma melaniceps, Boeck. Pl. V. figs. 1–12.

Off Seaton Carew and Seaham Harbour, in company with the foregoing species, but less abundantly.

The characters of this remarkable species are so distinct that I cannot doubt its identity with that described by Boeck, though I have not noticed any thing in my specimens which warrants the term *melaniceps*. Moreover the fifth foot consists of two branches, and not of one only as stated by that author, unless, indeed, the Norwegian animal be a different but closely allied member of the same genus.

Genus TACHIDIUS, Lilljeborg.

Tachidius brevicornis (Müller).

Cyclops brevicornis, Müller, Entomostraca, p. 118.
Tachidius brevicornis, Lillj., De Crustaceis; Brady, Nat. Hist. Trans. N. & D. vol. iv. p. 130, pl. 5. figs. 1–9.

In pools of brackish water at Hartlepool, Hylton Dene, and Seaton Sluice.

Genus IDYA, Philippi.

Idya furcata (Baird).

Canthocamptus furcatus, Baird, Brit. Entom. (1850).
Tisbe furcata, Lilljeborg, De Crustaceis (1853).

Tisbe ensifer, Fischer, Beitr. zur Kenntn. der Entom. (1860).
Idya barbigera (?), Phil. Wiegmann's Archiv (1843).

Very common amongst weeds in tide-pools.

Genus WESTWOODIA, Dana.

Westwoodia nobilis (Baird).

Harpacticus nobilis, Baird, Brit. Entom.

One specimen, on *Laminaria saccharina* at Roker (1871). Berwick Bay (*Dr. Baird*).

Genus DELAVALIA, Brady.

Delavalia palustris, Brady.

D. palustris, Brady, Nat. Hist. Trans. N. & D. vol. iv. p. 184, pl. 5. figs. 10–15.

In pools of brackish water at the side of the Seaton burn, above Seaton Sluice.

Genus CANTHOCAMPTUS, Westwood.

Canthocamptus imus, n. sp. Pl. IV. figs. 1–5.

Animal slender, sublinear. Superior antennæ of the *female* eight-jointed, the fourth, seventh, and eighth joints bearing several long setæ, the second and third each three of moderate length, the last joint having also five or six smaller marginal setæ arranged in a pectinate series; rostrum long and slender, curvate. Lower foot-jaw simple, chelate; inner margin of hand bearing in the middle one seta of moderate length. First joint of inner branch of first swimming-foot equal in length to the entire outer branch, second joint very short, third about half as long as first, bearing three terminal setæ, the middle one being very long and minutely pectinate at the extremity; outer branch of fifth pair oblong, having two long apical setæ, three shorter ones on outer and one on inner margin; inner branch ciliate on outer, and armed with five long setæ (the last of which is excessively slender) on inner margin. Ovisac single, curvate, containing but few (six to nine) ova, ranged in a single plane, and very large in proportion to the size of the animal. Length $\frac{1}{30}$ of an inch.

Hab. About ten miles off Seaham Harbour, in a depth of thirty fathoms on a muddy bottom: a few specimens only taken.

Genus LAOPHONTE, Philippi.

1. *Laophonte similis*? (Claus).

Cleta similis, Cls. Die Copepoden-Fauna von Nizza, p. 23, pl. 5. figs. 13–16.

Amongst weeds in tide-pools at Whitley, Cullercoats, and Sunderland, and in brackish water at Seaton Sluice.

My specimens do not entirely agree with the figures and descriptions given by Claus; but I am unwilling, without a more extended examination, to describe them as belonging to a distinct species.

2. *Laophonte lamellifera* (Claus).

Cleta lamellifera, Cls. Die frei-lebend. Copep. p. 123, pl. 15. figs. 21–24.

One specimen, on frond of *Laminaria saccharina* at Roker.

3. *Laophonte Hodgii*, n. sp. Pl. VI. figs. 1–9.

Upper antennæ six- or seven-jointed, those of the male (?) shorter and thicker than those of the female, rather densely setose; lower foot-jaw of moderate size, with a very long and slender slightly curved claw; outer branch of first foot three-jointed, short; fifth pair of feet foliaceous, larger in the male, the outer branch elongated, having four or six long setæ on the apex and outer margin; the inner wider, and bearing internally four or five marginal setæ, those situated near the apex being very long. Caudal segments in the female at least four times as long as broad.

Hab. Off Seaham, dredged in twenty to thirty fathoms. Several specimens were taken. I have a mournful pleasure in naming this species after my late friend, Mr. George Hodge, it having been taken during one of the last dredging-excursions in which I had the pleasure of his company.

Genus CLETODES, nov. gen.

Animal resembling *Laophonte* in general appearance. Upper antennæ six-jointed. All the four pairs of swimming-feet alike, and having the outer branch three-, the inner two-jointed. Lower foot-jaw chelate. Lower antennæ without a secondary branch.

Cletodes limicola, n. sp. Pl. VI. figs. 10–17.

Animal, when seen from above, elongated, distinctly indented at each ring of the body. First segment of cephalothorax short, about equal in length to the two following; second and third abdominal segments produced into spinous processes at the lower lateral angles. Upper antennæ in the *female* much shorter than the first cephalothoracic segment; first three joints short and nearly equal, fourth about half as long as the third, fifth as long as the third, but much more slender: in the *male* forming at the third joint a large vesiculiform swelling, last joint elongated and uncinate. Swimming-feet elongated, slender; the outer branch ciliated on the margins, bearing at the apex of each joint, on the external margin, a long slender spine; terminal spines long and slender; the middle joint has also a long apical seta at the inner margin: inner branch two-jointed, the first joint very small, the second long, almost filiform, and dividing at the extremity into one short and two very long lash-like branches. Fifth foot in the *female* foliaceous, the outer branch rather the longer, bearing one long seta at the apex and three shorter ones on the outer margin; inner branch with two long apical setæ: in the *male* the two branches are of nearly equal length, very narrow, simple, one branch bearing one, the other two long setæ at the apex. The caudal segments short, but longer in the male than in the female; setæ one on each segment, scarcely longer than the segment itself. Length $\frac{1}{33}$ of an inch.

Hab. Off Seaham Harbour, in a depth of from twenty to thirty fathoms, on a soft muddy bottom. Two specimens only taken. On account of the peculiar structure of the swimming-feet, which were identical in both examples, I think I am justified in referring these to the male and female of the same species. The genus approaches *Lilljeborgia* of Claus; but the characters given by that author, "*Pedum sequentium* (2, 3, 4) *rami interni rudimentarii, rami externi triarticulati, uncinati,*" do not apply here.

Genus Harpacticus, M.-Edwards.

1. *Harpacticus chelifer* (O. F. Müller).

Cyclops chelifer, Müller, Entomostraca (1798).
Harpacticus chelifer, Claus, Die frei-lebend. Copep. (1863); Boeck, Oversigt Norges Copep. (1864).
(Not *H. chelifer* of Lilljeborg.)

Not uncommon amongst weeds between tide-marks, Roker, Whitley, &c. In the open sea, off Seaton Carew.

2. *Harpacticus gracilis*, Claus.

H. gracilis, Claus, Die frei-lebend. Copep. (1863).
H. elongatus, Boeck, Oversigt Norges Copep. (1864).

This occurs in the same situations, though not so frequently as the foregoing species. M. Boeck doubts the identity of his *H. elongatus* with Claus's *gracilis*, on account of a difference in the lengths of the antennal joints. This character, however, seems to me to be often subject to considerable variation; and I should not, without some divergence in other respects, be disposed to separate the two forms. Indeed both approach so closely to *H. chelifer* that it seems questionable whether they might not be more fitly regarded as varieties of that species.

3. *Harpacticus fulvus*, Fischer.

H. fulvus, Fisch. Beiträge zur Kenntniss der Entom. (1860); G. O. Sars, Som. 1862 Zool. Reise.
H. curticornis, Boeck, *loc. cit.* p. 38 (1864).
H. chelifer, Lilljeborg, De Crustaceis ex ord. trib.
Tigriopus Lilljeborgii, Norman, Last Shetland Dredging Report, p. 296.

In pools at or above high-water mark, Bamborough, Cullercoats, Marsden. Boeck and Sars both describe this species as inhabiting chiefly pools at or above high-water mark, which are liable to get warmed by the sun. In such situations it is often extremely abundant in our district.

4. *Harpacticus nicæensis* ?, Claus.

Harpacticus nicæensis, Claus, Die Copep.-Fauna von Nizza, p. 31, pl. 2. figs. 12–14.

A few specimens which I doubtfully refer to this species have occurred to me on the fronds of *Laminaria saccharina* and other Fuci at Sunderland and Ryhope.

Genus ZAUS, Goodsir.

Zaus spinosus, Goodsir.

Z. spinosus, Goodsir, Edinburgh New Phil. Journ. (1842); Claus, Die freilebend. Copep. (1863); Boeck, Oversigt Norges Copep. (1864).

Common on Fuci, and especially on the fronds of *Laminariæ*, in tidal pools and beyond low-water mark, Roker, Ryhope, Sunderland, Cullercoats, &c. Shetland (*Rev. A. M. Norman*).

Genus THALESTRIS, Claus.

1. *Thalestris longimana*, Claus.

Frequent on the smaller weeds and on *Laminariæ* in tidal pools, Roker, Sunderland, Ryhope, &c. Also in the open sea, but more rarely.

2. *Thalestris helgolandica* ?, Claus.

On *Laminariæ* in tide-pools at Roker; not common.

3. *Thalestris harpactoides*, Claus.

In the surface-net off Grimsby and Teesmouth.

4. *Thalestris Clausii*, Norman.

T. Clausii, Norman, Last Shetland Dredging Report.

Frequent on *Laminaria saccharina* and other weeds in tide-pools, Ryhope, Sunderland, Roker, Whitley, &c.

Genus Dactylopus, Claus.

1. *Dactylopus tisboides*, Claus.

On *Laminaria saccharina* at Roker and Ryhope; scarce. Abundant in brackish pools at Seaton Sluice.

2. *Dactylopus similis*, Claus.

One specimen, dredged in a depth of four fathoms off Seaton Carew.

3. *Dactylopus brevicornis*, Claus.

On *Laminaria saccharina* at Roker; not common.

4. *Dactylopus Normani*, n. sp. Pl. V. figs. 13–17.

Closely approaching *D. tisboides*, from which it differs, however, in the following particulars:—The superior antennæ are eight-jointed, and not so densely setose, the proportional lengths of the various joints being as follows:—$\frac{1}{6}$, $\frac{2}{5}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{2}$, $\frac{6}{3}$, $\frac{7}{8}$, $\frac{8}{4}$. The secondary branch of the lower antennæ biarticulate, each joint bearing two moderately long setæ. Lower foot-jaw (gnathopod) simply chelate; the inner margin of the hand fringed with short setæ. Longer branch of the first foot slender, bearing almost at the extremity of the outer margin a short ciliated seta. Fifth pair of feet large; outer branch subovate, bearing three long setæ (one at the apex, one on each lateral margin), and three shorter ones on the outer margin between the apical and lateral setæ; inner branch very much smaller, subquadrate, extending only half the length of the outer, bearing four primary setæ, two of them long and two of moderate length, the interspaces being densely ciliated.

Hab. Roker, on *Laminaria saccharina*; rare.

Genus Scutellidium, Claus.

Scutellidium tisboides, Claus. Pl. IV. figs. 6–10.

One specimen, on the frond of *Laminaria saccharina* at Roker.

Genus Alteutha, Baird.

1. *Alteutha bopyroides*, Claus.

Often taken abundantly in the surface-net, all round the British Islands.

2. *Alteutha purpurocincta*, Norman.

A. purpurocincta, Norman, Last Shetland Dredging Report.
Peltidium purpureum, White, Pop. Hist. Brit. Crust.

On *Laminaria saccharina* at Roker and Cullercoats; frequent. Shetland (*Rev. A. M. Norman*).

3. *Alteutha depressa*, Baird.

This species, described by Dr. Baird in his 'Natural History of the British Entomostraca,' is unknown to me, and appears not to have been recognized by any other author. It was taken by Dr. Baird in Berwick Bay.

Genus ASPIDISCUS, Norman.

Aspidiscus fasciatus, Norman, Last Shetland Dredging Report, p. 298.

Abundant on the fronds of *Laminaria saccharina* at Roker, Sunderland, and Cullercoats. Shetland (*Rev. A. M. Norman*).

EXPLANATION OF THE PLATES.

PLATE II.

Fig. 1. *Pseudocyclops crassiremis* (male): animal, seen from right side, × 84. *Fig.* 2. Superior antenna of right side, × 210. *Fig.* 3. Superior antenna of left side, × 210. *Fig.* 4. Inferior antenna, × 210. *Fig.* 5. Maxilla, × 210. *Fig.* 6. Lower foot-jaw, × 210. *Fig.* 7. Fifth pair of feet, × 120. *Fig.* 8. Last abdominal segments and tail, × 84.

Fig. 9. *Cyclops littoralis*, superior antenna, × 210. *Fig.* 10. Inferior antenna, × 210. *Fig.* 11. Mandible, × 210. *Fig.* 12. Upper foot-jaw (?), × 210. *Fig.* 13. Lower foot-jaw, × 210. *Fig.* 14. Abdomen and tail: *a*, foot of fifth pair: × 210.

PLATE III.

Fig. 1. *Cyclops ovalis*, superior antenna, × 120. *Fig.* 2. Abdomen and tail, × 120.

Fig. 3. *Cyclopicera lata*, superior antenna, × 210. *Fig.* 4. Inferior antenna, × 210. *Fig.* 5. Maxilla, × 210. *Fig.* 6. Upper foot-jaw, × 210. *Fig.* 7. Lower foot-jaw, × 210. *Fig.* 8. Abdomen and tail: *a*, foot of fifth pair: × 120.

Fig. 9. *Macrochiron fucicolum*, male (?), seen from right side, × 100. *Fig.* 10. Upper antenna of male, × 220. *Fig.* 11. Upper antenna of female, × 220. *Fig.* 12. Lower antenna, × 220. *Fig.* 13. Mandible, × 220. *Fig.* 14. Lower foot-jaw, × 220. *Fig.* 15. Foot of fourth pair, × 220. *Fig.* 16. Foot of fifth pair (male), × 220. *Fig.* 17. Foot of fifth pair (female), × 220. *Fig.* 18. Caudal segment and setæ, × 220.

PLATE IV.

Fig. 1. *Canthocamptus imus* (female): animal, seen from left side, × 100. *Fig.* 2. Superior antenna, × 250. *Fig.* 3. Lower foot-jaw, × 250. *Fig.* 4. Foot of first pair, × 250. *Fig.* 5. Foot of fifth pair, × 250.

Fig. 6. *Scutellidium tisboides* (female), upper antenna, × 210. *Fig.* 7. Mandible and maxilla, × 210. *Fig.* 8. Foot of first pair, × 210. *Fig.* 9. Lower foot-jaw, × 210. *Fig.* 10. Foot of fifth pair, × 210.

PLATE V.

Fig. 1. *Ectinosoma melaniceps*, female (?), seen from right side, × 84. *Fig.* 2. Superior antenna, × 210. *Fig.* 3. Lower antenna, × 210. *Fig.* 4. Mandible: *a*, origin of palp, × 300. *Fig.* 5. Mandible-palp, × 300. *Fig.* 6. Maxilla, × 300. *Fig.* 7. Upper foot-jaw, × 300. *Fig.* 8. Lower foot-jaw, × 300. *Fig.* 9. Foot of first pair, × 210. *Fig.* 10. Posterior abdominal segments and setæ, × 120. *Fig.* 11. Foot of fifth pair, × 210. *Fig.* 12. Maxillary appendage (?).

Fig. 13. *Dactylopus Normani*, superior antenna, × 210. *Fig.* 14. Lower foot-jaw, × 210. *Fig.* 15. Foot of first pair, × 210. *Fig.* 16. Secondary branch of lower antenna, × 210. *Fig.* 17. Fifth pair of feet, × 210.

PLATE VI.

Fig. 1. *Laophonte Hodgii*, upper antenna of female, × 210. *Fig.* 2. Upper antenna of male, × 210. *Fig.* 3. Lower foot-jaw, × 210. *Fig.* 4. Foot of first pair, × 210. *Fig.* 5. Foot of fourth pair, × 210. *Fig.* 6. Fifth foot of female, × 250. *Fig.* 7. Fifth foot of male, × 250. *Fig.* 8. Caudal segment of female, × 250. *Fig.* 9. Caudal segment of male, × 210.

Fig. 10. *Cletodes limicola*, female, seen from above, × 100. *Fig.* 11. Upper antenna of female, × 250. *Fig.* 12. Upper antenna of male, × 250. *Fig.* 13. Lower foot-jaw, × 250. *Fig.* 14. Foot of first pair, × 250. *Fig.* 15. Foot of fifth pair, female, × 250. *Fig.* 16. Foot of fifth pair, male, × 250. *Fig.* 17. Caudal segment of female, × 250.

II.—*Further Observations on the Myology of* Sarcophilus ursinus. By ALEXANDER MACALISTER, M.B., Professor of Zoology, University of Dublin, and Director of the University Museum.

IN the 'Annals' for March 1870 I published an account of the dissection of a young female Tasmanian Devil. Since that time three specimens of this species have been brought alive to the Dublin Zoological Gardens. Two of these still live, and are in an exceedingly healthy condition; one, however, did not survive its imprisonment for more than a few months; and I have had the opportunity of making a careful examination of its muscles and of repeating my former observations.

As this second specimen was fresh, a male, and full-grown, it was in far better condition for examination than its predecessor in our dissecting-room, which was a salted specimen. This individual was 30 inches long, and his muscles were red, plump, and strong.

The platysma myoides, and indeed all parts of the panniculus carnosus, were very strong and red, contrasting decidedly with the weak undefined condition which they exhibited in the former specimen. The cervical portion of this muscle formed a thick strong sheet, which passed from the occipital and mastoid regions downwards and forwards, over the movable clavicle and over the humeral region, to be attached to the integument in the vicinity of the elbow. The dorsal and abdomino-lateral and femoral parts of the panniculus were particularly strong.

The muscles of mastication were exceedingly remarkable in their development. The masseter was distinctly bilaminar, the superficial portion being four times the size of the deeper; the directions of the two laminæ were exceedingly oblique. The temporal was of enormous size, three times the size of the external masseter; the pterygoids were smaller, the external being exceedingly feeble; the internal was also small. The most expressive way of representing the enormous size of these muscles is by stating that the weights of the muscles which elevate the lower jaw (masseters, pterygoids, and temporals) were equal to the sum of the weights of all the scapular and brachial muscles (deltoids, spinates, biceps, brachiales, triceps, &c.), or to the entire series of muscles which act on the shoulder-joint (pectorals, latissimus dorsi, spinati, deltoids, &c.). This will give some idea of the power with which these formidable creatures can close their mouths. (However, the habits of the two specimens in the Zoological Gardens do not seem to indicate the great degree of ferocity for which the species has got credit.)

The trapezius arose from only four dorsal spines (in my other specimen it extended to seven); the clavicular portion was distinctly attached to the outer third of the clavicle. The central portion of the cervical and upper part of the muscle was directly continuous with the acromial (not the clavicular) deltoid; and, gliding over the shoulder, this portion was inserted into the lowest part of the deltoidal crest.

The latissimus dorsi was attached to the lowest five dorsal spines, and to the spines of three lumbar vertebræ, and only to the tip of the last rib: I was able to separate it clearly from the pectoralis quartus (from which it was not easily distinguished in the last specimen); its tendon of insertion was rather below that of the teres major.

Rhomboideus major was only attached to three dorsal spines. The serratus magnus arose from the seven upper ribs and the four lower cervical transverse processes; a detached slip arose from the second and third cervical transverse processes, and represented a levator scapulæ.

The cleido-mastoid was small and separate, one third the size of the sterno-mastoid.

There were two trachelo-acromiales muscles, as in the otter, one from the transverse process of the atlas to the outer half of the scapular spine; the other arose from the same process further back, and was inserted into the posterior third of the scapular spine. In the former specimen I missed the posterior portion of this muscle.

The supraspinatus is double the size of the infraspinatus, and equal to the subscapularis. There is a distinct small teres minor; I could not separate it in my former specimen. The subclavius was not only attached to the clavicle, but also extended beneath that bone to the spine of the scapula.

The deltoid consisted of three parts:—a clavicular, from the outer half of the clavicle (this I before thought was acromial); an acromial, continuous with the trapezius; and a scapular, from the metacromion and anterior half of the scapular spine.

The pectoralis quartus was a strap-like band from the linea alba of the abdomen (extending upwards for ·2 of an inch from a point ·25 above the umbilicus); its insertion is above that of the pectoralis minor.

The two tendons of the biceps were very closely tied together, and the main body of the muscle was radial in its insertion; yet there was a very slender ulnar slip. The biceps was twice the size of the brachialis (·32 oz.: ·16 oz.). The extensor mass was very much in excess of the flexors (1·67 oz.: 0·48 oz.). The anconæus externus was inseparable from the triceps, but the anconæus internus was very distinct. The palmaris was as described in my former paper.

A careful dissection satisfied me that the slip which I had before taken as a supinator longus was really only a slip of the panniculus carnosus—as it had no bony attachment, but was directly continuous with the continued slip of the platysma: the only supinator is the short one, which nearly equals in weight the pronator quadratus. The extensor secundus digitorum was only attached to the fourth and fifth digits; and the former digit had two tendons supplying it (in my former specimen there were four tendons—two to the fifth, one to the third, and one to the fourth). A separate slip (ulnaris quinti) existed, which arose with the extensor carpi ulnaris, and, passing in the groove in the annular ligament with the extensor minimi digiti, is inserted into the base of the fifth metacarpal bone.

The psoas magnus and the iliacus are easily separated from each other; these, taken together, are four times the size of the psoas parvus. The pectineus was not double, as it was in the former specimen. The upper slip of the obturator externus was semidetached from the rest of the muscle.

The quadratus femoris was very remarkable, arising from the transverse process of the first caudal vertebra, from the tuber ischii, and a tendinous band which passed from the one to the other. Gluteus minimus was easily separable from the medius. A very thin slip represented the obturator internus. Tensor vaginæ femoris is separate and thin. Sartorius is exceedingly feeble. The biceps flexor cruris arises only from the tuber ischii and two caudal vertebræ.

The "bicipiti accessorius" was quite distinct at its origin, but joined at its insertion to the semitendinosus—which muscle was thus tricipital, having one head caudal overlapping the biceps, one ischiatic, and, thirdly, this accessorius. The two other heads are similar to those which exist for the same muscle in *Castor fiber*, *Atherura*, and the Otter. There is a middle head of the gastrocnemius, which joins the external.

The peronæi and tibial muscles were exactly similar to those in my former specimen. The foot-muscles were as follows:—Abductor ossis metatarsi minimi digiti, from the os calcis to the spur of the fifth metatarsal; abductor minimi digiti, a superficial muscle, with a short triangular belly and a long tendon, which arises from the external annular ligament over the peronæi tendons, and is inserted into the fascia over the flexor tendon of the little toe.

The lumbricales were six in number—one to the inner and one to the outer side of the outer toe, a similar pair for the fourth toe, a single internal muscle for the third and one for the second toes.

The rudimental hallux has two muscles—a flexor brevis, which extends from the scaphoid bone to the first phalanx, and an exceedingly fine triangular and superficial adductor, which arises superficial to the palmar interosseous muscle for the index toe, and is inserted into the inner side of the first phalanx of the hallux.

The interossei were three plantar and four dorsal, the former being (1) adductor indicis, (2) adductor quarti digiti, (3) adductor quinti digiti; the latter were (1) abductor indicis, (2) adductor tertii digiti, (3) abductor tertii, and (4) abductor quarti digiti.

The only other points worthy of note were the extension of the scalenus posticus to the upper four ribs, of the external oblique to the ten lowermost, the absence of ilio-costal fibres in the quadratus lumborum, an enormous triangularis sterni, a two-bellied depressor of the mandible, whose anterior portion is connected to and parallel with the genio-hyoid, with which it agrees in function.

III.—*The Origin of the Vertebrate Skeleton.*

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[Continued from vol. ix. p. 280.]

§ 3. *The Physics of the Skeleton.*

The next step after a study of growth is to observe in what directions growth usually occurs; then we may discover the forces which accumulate the energy that results in such growth. All animals of the kinds named Vertebrata have their internal bones arranged in a way which in many respects is the same for them all—a great antero-posterior extension; and this arrangement is named the skeleton. But when animals are contrasted with each other, they manifest differences in the degree of growth, and in the presence or absence of some of their bones; and these peculiarities, being persistent through an immense number of variously modified individuals, give to the skeleton a number of different plans, which admit of being defined. And out of these considerations arise the great problems affecting all bones, which will here be stated. They are:—What is the skeleton, and why has it an existence as a skeleton? and what are the plans of growth of the skeleton among vertebrate animals, and why do those plans exist?

Here, then, the skeleton first appears as an accomplished fact, without visible genesis beyond such as may be traced in each individual, where changes are observed to occur in the bones after an animal has left the egg or the uterus, which are in sequence from their first formation to completed growth.

By the skeleton, I understand in the foregoing passage the vertebrate skeleton only; and I wish, for convenience, to keep the idea of the vertebrate skeleton distinct from other important osseous machinery of vertebrates, which is better named the appendicular bones, the dermal bones, and the respiratory bones. The reason for this distinction is that the nature of their relation to the axial skeleton must first be demonstrated before it can be reasoned upon. The vertebrate skeleton, moreover, is the only one which is well developed in every vertebrate animal, the other bones being variable and giving characters to the plans of the subordinate sections. Thus the Vertebrata admit of being defined as those animals in which the elongated central nervous system is sheathed posteriorly by a sequence of osseous rings, and anteriorly by a bony box—the rings being the vertebræ protecting the spinal cord, while the box is the skull covering the brain. This definition includes all the animals classed by zoologists as Vertebrata, excepting the lancelet (*Amphioxus*), which, for reasons given in the chapter on classification, must be regarded as forming a group of equal zoological value with the Vertebrata.

The division of the nervous system and of the skeleton into a long posterior part and a wide anterior part is the essential vertebrate character. And if we are to understand what characters are essential, and why they undergo change, an attempt must be made to state clearly what they are, and why they exist. It will be sufficient, with regard to the spinal column, to know that it is a central, somewhat cylindrical mass, extending the length of the vertebral column generally, giving off at intervals pairs of nerves, and tapering towards the tail. While the brain is posteriorly continuous with the spinal cord, it is much larger, and consists of parts which are sometimes arranged one before the other, and sometimes one over the other; it usually gives off nerves to the eyes, the ears, the nose, &c.

The vertebræ have a common basis, on which the neural column rests, and which is a subcylindrical column, called the notochord. When segmented and ossified, it forms the part of each vertebra named the centrum; and this centrum gives attachment to a pair of bones which arch over the spinal cord and are separated from others by the intervertebral nerves; they may become inseparably united to the centrum or always remain distinct. The skull is made by a number of small bones which suturally unite, or simply overlap each other, so as to enclose the brain, which case usually may be separated vertically down the sutures into three more or less well-defined segments, each consisting of a bone at the base, a bone on each side for the sides of the arch, and one or two bones above vaulting it over. A necessary and separate part of the skull is comprised generally under the terms upper and lower jaws.

Now we have to inquire why these parts exist—in other words, how they come to grow. And all growth has been seen to be organic dialysis, which takes place under the influence of alternating pressure and tension and rest. How, then, does this law apply to the formation of the vertebrate skeleton, and account for the formation of bones so deeply seated and well protected, and for the formation and complexity of brains and crania? I will endeavour to explain.

All vertebrate animals are locomotive, and all fish and all immature Amphibia live in water. These animals progress backward, though we usually name the motion forward; that is, each uses its tail to obtain a leverage by which it retreats, the animal's head necessarily going where the tail sends it. It is therefore evident that the head, in piercing the water, experiences some pressure alternating with rest, while the body experiences a serpentine motion originated by the tail and passing forward. To understand clearly the effects upon the animal of this movement, it will be useful to study it experimentally. If, then, I take an ordinary long bolster, which in its cylindrical form will represent a fish, and hold firmly one extremity of it (which for convenience I suppose to be its tail), and then imitate the movement of the fish by moving the tail powerfully from side to side, it will be seen that the movement propels the feathers towards the free end of the bolster; that is, by granting the bolster a tail, I have elaborated for it a head also. Now to apply this principle to the fish. Instead of the force furnished by my hands, there are enormous muscles extending down the body; instead of the bed-ticking for an outer envelope, there is a vertebral column; and finally, instead of feathers inside of it, there is the central nervous system, which, in the young state at least, is centrally fluid. Now, if the tail is set moving as it is seen to move in a fish out of water, the powerful pressure behind will compress the light semifluid substance of the spinal cord and force it to move forward, and this movement is maintained during the life of the individual; it will also by the tension increase the length of the spinal matter relatively to the osseous sheath. The mechanical effect, then, of motion originated by the tail is an immense amount of leverage applied at every point of the curve of the body, which inevitably acts upon the contents of the spinal tube in compressing and forcing the substance forward. It also must act, as all tension and pressure have been seen to act, in stimulating the growth of the spinal cord.

Thus there is a persistent influence ever tending to elongate the spinal column. As it was seen that there is an actual forcing of the spinal cord forward, so this growth will tend in the same way. But I have already pointed out how soon the individual power to be modified in form comes to an end, although the forces capable of modifying the organism continue to act,—and that thus the energy of life is not lost, but becomes potential for a time in the parent, and can only be manifested kinetically when a bud or ovum which has in it a capacity for mobility which the parent had not, is thrown off from the organism; and then, under the name of a variety, we see manifested the potential activity of the parent which its organization had previously compelled to remain as potential activity. So that we cannot expect to find these forces producing large visible effects under our eyes in one individual. But we must expect that in a succession of individuals, each of which remains for a certain period capable of modification, the force which is potential and persistent, and in each individual is renewed, will, as the opportunities for it to take the kinetic form successively arrive, be manifested as fully as it would originally have been in one individual if the organic machinery had been capable of maintaining the nutrition necessary to elaborate growth. I shall thus be justified in reasoning about the species as though it were an individual, and to conclude that the force which has been shown, both theoretically and experimentally, to be competent to produce an elongation of the spinal cord toward the part called the head, actually does produce the effects which it ought to produce. And the way in which this is done depends upon the means to do it: first, the forcing of the nutritive fluid forward necessarily produces an enlargement of the nervous system at the anterior end; and, secondly, the growth forward of the nervous system must cause a pressure which will stimulate special growth in that region; and the parts of the brain which were originally arranged one before each other may come to be forced one over the other by growth forward of the neural tissue pressing into the brain-case.

And when a brain is examined, in it are found large cavities called ventricles, which are the receptacles of fluid, such as we might theoretically expect. And when the brains of the lower Vertebrata are compared with those of the higher Vertebrata, there will be remarked a gradual increase, as we ascend in organization, in the size of the cerebral lobes, which first push the optic lobes on each side so that the cerebrum abuts against the cerebellum, and finally overrides it. Therefore it must be anticipated that the longer the time for which a vertebrate type of animal has persisted upon the earth's surface, the higher will be its nervous organization; and hence that extinct animals which seem to be the direct representatives, so far as their bones go, of existing animals, will, so far as they approach nearer to the common vertebrate plan, have had a lower grade of vital organs. Having seen that the movement of the body would be competent, by governing the direction of growth and the distribution of nutriment, to generate the brain from a pre-existing spinal cord, it is probable that the nerves are in the same way affluents to and sustainers of the spinal column, and that their presence preserves its division into segments.

Having advanced this hypothesis of the vertebrate plan of the central neural system, we will endeavour to see how the nerve-matter becomes coated with the investing skeleton. And to do this, it will be requisite to consider the entire body as a machine capable of manifesting the forces of pressure and tension, and to examine how the part of the body under consideration can be affected by these forces.

It is due to Mr. Herbert Spencer to state that he has endeavoured to grapple with this question; but, although he appreciated fully the simple mechanical conditions of the problem, he seems to me to have failed to solve it. His argument is that when pressure is manifested on alternate sides of a rod, there will be a neutral axis within it which only experiences small compressions, and external to that an investing region, where pressure and tension alternate. He then tries to apply that principle to a fish. The principle would be perfectly applicable to a long bone, and would account for its being hollow or less dense internally; but it is not applicable to a fish, because there is nothing to correspond to the hollowness of a bone in the middle line of the animal; and, on the contrary, the region which should be the unossified neutral axis is the ossified neural skeleton—a condition exactly the reverse of what it should be were Mr. Spencer's hypothesis true. Mr. Spencer's error consists in not recognizing that the muscles of the body are, in regard to the production of the neural skeleton, precisely what the weight is which bends a revolving flexible rod—the power which produces a neutral axis, and which also produces the pressure and tension in which we have seen that ossifications arise[*].

In seeking to explain this formation of an osseous skeleton, instead of taking an abstract, impossible archetype to reason from, my argument may be clearer if we examine the conditions of the problem as presented in some animal. Having the choice of animals, among which a Chelonian would be the least suitable, the most difficult skeleton to understand, I select a whiting. The fish manifests locomotive energy; and to find the source of this mechanical power, I skin her. The skin requires to be dissected off, on account of its close union with the constituent fibres of the muscles; and in some parts of the body there are attached to it special skin-muscles in addition. The skin removed, there is seen an enormous development of muscles, which are arranged in a very marked way. Fibres extend from the skin obliquely inward toward the skeleton; and these fibres are grouped into obliquely placed muscles, which are arranged along the animal parallel to each other, so as to make large strips of similar muscles, which reach from tail to head. In the tail of the whiting there are four of these strips on each side; and the constituent muscles are so arranged that the obliquity of the four series makes a W-like outline when traced externally from the dorsal to the ventral surface, the upper part of the W being towards the animal's head. Here, then, is an immense muscular power, so arranged as to act in many directions.

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[*] Principles of Biology, vol. ii. p. 196.

Removing the whole of the muscles, we expose the vertebrate skeleton beneath them, and find that each transverse muscular segment corresponds with a transverse osseous segment; and that the direction of the muscles of the two middle strips of the W coincides with the direction of the dorsal and abdominal processes of the vertebræ, and with the nerves. These middle muscular strips are large compared with the superior and inferior strips; and in transverse section each often shows, by the method of overlapping, an approach to a concentric arrangement of the constituent muscles in the region of the tail. The forces represented by these muscles are, I believe, precisely such in their distribution and combination as theoretically might have been anticipated. But, before considering the effects of their action, it is to be remarked that the discovery of a notochord among the Tunicata lends strong probability to the supposition that the notochord, which extends beneath the neural chord, is not a product, but one of the original foundations, of the vertebrate plan. But, granting a notochord, it is impossible, without a stretch of imagination, under which the reason gives way, to assume the existence of a mass of muscle like that which makes the great bulk of a fish, and then try to account for its segmented condition, as Mr. Herbert Spencer does, by lateral breaking strains. In nature, so far as I am aware, no such phenomenon exists. And it seems to me as gratuitous to assume the existence of the muscles, in order to have them subsequently segmented by these imaginary lateral strains, produced without any force to produce them, as it is to suppose that the foundation of the vertebral column is laid by breaking strains segmenting the notochord. Before such views can claim to be considered in science, their author is bound to show that an animal is acted upon by lateral forces external to itself, and that an effect of such strains would be to cause the muscular tissues to snap into little short muscles, and that such strains continued would eventually pass through the whole of the animal except its skin and viscera! In the chapter on growth, we have seen that the consequences of strains would be, not a weakening, but a strengthening of the tissues.

In the axial part of a fish, a serpent, or indeed in any animal, the successive segments, both of bone and muscle, are exceedingly similar to each other. Almost at all parts of the trunk two adjacent vertebræ can only be distinguished from each other by close comparison, if they are in the same division of the body. And there being this sequence, the form of parts only changing with the changed function of different regions of the body, it will be legitimate reasoning, if we can discover a law capable of accounting for a primitive initial segment, to conclude that the continuous operation of that law would eventually segment the entire animal, *if an animal capable of being encased in a segmented covering already existed.*

According to the laws of growth, we find that differentiation of parts is due to the kinetic energy of the individual or to the potential energy of its organization—and that no organic energy is lost, but becomes accumulated in the individual long after the mobility of the parts ceases, and then is transmitted with and added to the common stock of energy to be inherited. If this inherited energy is such that it is capable of being manifested within the mobile period of life, then it will stamp its characteristic marks upon the organism. But if it is too general to be manifested during that period, it takes a potential form, and may even remain latent for several generations and accumulate, and then, instead of being developed kinetically in the individual, it at an early period is merged in the common stock, and appears kinetically in the organization, and potentially in the individual, as a new part.

Thus in Ophidians, which exert continually an intense muscular force upon every joint of the vertebral column, we find that the kinetic energy is manifested in giving to the bones great density, sharpness of definition, and perfect ossification, but never in the partial formation of a growth like an epiphysis, between vertebræ. Yet, if the views which I urge are true views, there should be some result, in increased ossification, of all this muscular power; and the result is found in the numerical increase of the vertebræ, so that in Ophidians they sometimes number 400 or 500. But this increase is potential, and takes place at so early a period that the newly added segment (vertebræ, muscles, nerves, &c.) is developed equally with the others. If the increase takes place in the thoracic region, it necessarily elongates the viscera; if the tail is lengthened, by comparison the body appears to be shortened.

If we take another type, that of the Anurous Amphibia, which do not display muscular power by wrigglings which press and pull the vertebræ, as among serpents, but progress by leaping, and keep the body removed from the ground, except at the caudal style, the power, both kinetic and potential, acts chiefly on the limbs—kinetically in the elongation and hollowness of the limb-bones, the ilia, &c., potentially (perhaps) in the formation of investing epiphyses at their ends—but in scarcely an appreciable way upon the vertebræ in either form, since they remain both very few in number and short.

It cannot be necessary to multiply these illustrations; for the same law may be traced in every osseous structure. Where an animal uses any part of the body, the part grows long, either kinetically by lengthening the individual parts, or potentially by increasing their number.

If, now, we generalize these facts in relation to the vertebral column, the result is, that since the potential epiphyses multiply indefinitely and elongate the body, so there must have been a period when the body was short and when the segments were very few—and that the elongation of the body proceeds gradually, and, except in the caudal region, is likely to be arrested by the development of limbs.

It were simplest to assume, if there had been grounds for doing so, a single vertebra as the basis from which the body was formed; but the existence of a notochord among tunicaries, and the vast gap between *Amphioxus* and ordinary vertebrates, does not warrant such an assumption; nor does it indeed enter practically into my theory of a vertebrate. However, if we assume an animal with the viscera of a fish, with a notochord, and with terminal muscles capable of moving the tail, then the consequence of that arrangement would be the formation of a terminal segment, not by breaking a piece off the notochord, but by the muscular action increasing the density of the terminal portion, and this organic dialysis eventually giving it a structure by which it is chemically separated from the other parts. The direction of the mechanical strain becomes the direction of greatest density, and determines the directions in which the osseous matter is deposited and the shapes which it assumes.

Then, just as the inherited energy of many individuals at last became a force sufficient to differentiate the first osseous caudal segment, so the continuous operation of the same muscles goes on accumulating energy for which there can be no outlet in the adult organization, and the energy takes the potential form. It has, in fact, become so powerful that, instead of displaying itself only in maturity, it begins to act upon the immature animal at as early a time as the other and ordinary laws of its growth, and in this way gives expression to itself, differentiating a new segment similar to the preexisting segment—a potential epiphysis, which, growing continuously with the original segment, can afterwards scarcely be distinguished from it. Thus the tail comes to have two segments; and so the process must go on, the vertebræ increasing in number and extending further towards the head, till the basis of a vertebral column is elaborated. So far as I am aware, this hypothesis is in accord with the sum of the facts, and gives an explanation of their relation to each other. And not only does it account for the original existence of a vertebral column, but for its subsequent modifications, and for the repetition of the successive similar soft parts (muscles and nerves) which are correlated with the bones.

But so far we only account for the centrum of a vertebra. In our usual conception of it, especially as seen in the fish's tail, it includes an arch on the dorsal part, called the neural arch, which covers the neural column, and a similar arch on the ventral side, called the hæmal arch, which covers a blood-vessel. In dissecting a fish, the muscles in the tail of the dorsal and hæmal sides of the animal are seen to be as like each other as are the neural and hæmal arches; so that it will be in accord with the mechanical basis on which this investigation started to conclude that in both cases a like force has produced a like result.

But how? If we grant the differentiation of an initial caudal segment of the notochord by muscular power, then as those lateral muscles of the tail, acting obliquely, enlarge, they would, with increasing force, become competent to set up a separate ossification upon the notochord at each of the margins of their overgrowth. And these points, it is to be remarked, coincide with the points of origin from the centrum of the lateral parts of the two arches. When once these kinetic epiphyses are brought into existence, the lateral muscular attachment would ensure their growth, and the dorsal and ventral muscles would as surely draw them towards each other above and below. Thus the fundamental plan of the tail of a fish in its soft parts supplies the machinery necessary to elaborate the hard parts; and from their less bulk and the greater relative power brought to bear upon them, it would seem not improbable that the neural and hæmal arches should be ossified at an earlier period in the history of the organization than the centrum. And this muscular power would be competent, if the arches long remained separate from the centrum, to draw them towards each other, so that the dorsal part of every neural arch would abut against the dorsal part of the arch next behind it. Thus there will come to be formed interlocking facets between the arches, of which the anterior will look upward while the posterior will look downward: in most animals the neural arches actually have such facets, which are known as anterior and posterior zygapophyses.

In the median lateral line between the great lateral muscles slight transverse processes are sometimes developed; and these may be upon the centrum, or upon the neural arch, or upon the hæmal arch, according to the arrangement of the muscles. But the point is one of detail, and not a fundamental part of the vertebrate common plan. As the caudal vertebræ progress forward towards the head, they encounter the viscera on the hæmal side; and then the hæmal arch widens and embraces the viscera, so that the parts called hæmapophyses, which in the tail are directed downward, come in the thorax to be lifted up the side of the centrum and directed outward, sometimes attached to the median lateral osseous process, and often connate with it. When the viscera extend to a great length down the body, the lateral transverse processes are not developed as distinct processes; when the viscera have a short extension and the tail is long, they are considerably developed, and then pass forward as epiphyses upon the visceral region, being developed at the point of junction of the hæmapophysis with the part of the centrum which supports it. In this form the hæmal arch is called a rib. And as the arch widens, new elements come to be introduced into the circle which it constitutes—formed toward the ventral surface by the increased expansion given to the ventral strips of muscles, which often become blended with the lower lateral strips.

In this way I conceive the vertebrate common plan to have been elaborated, so far as its osteological structures are concerned, by the mechanical machinery with which it is inevitably accompanied. And if so, it will be evident that all subsequent variations it may assume in form will be due to a different distribution of the muscular machinery resulting from kinetic growth, while the different proportions of the different regions of the column will be due to potential growth.

In first conceiving of a vertebrate I introduced two ideas—the tail and its product, the head. In obtaining a similar generalized idea of the head to that just given of the body, it may be as well to remark:—that the extension forward of the vertebræ will have maintained the spinal cord of approximately uniform size up to the point where, like the constricted neck of a bottle, it abuts against the enlarged terminal part; and that the transition in the dorsal region from neural matter covered by a vertebra to the brain covered by the skull is not dissimilar in kind to the transition seen on the hæmal surface, where the tail suddenly expands and covers the viscera, only with this difference—that while the brain experiences but very slight fluctuations in size, the viscera are constantly undergoing change. Both hæmal and neural parts terminate in the head, but under these different conditions—that while the neural arch is being modified for the first time, the hæmal arch undergoes its second transformation, which may be altered to some extent by the relation of the two arches to each other; so that, on *à priori* grounds, the hæmal arch in the skull may be expected to be more complex than the neural arch, and also to more readily assimilate to the hæmal arches of the body.

Now, if the brain-substance is supposed to have accumulated at the anterior end of the body as a consequence of the motion and mode of growth of the animal, and quite irrespective of the vertebræ, its covering from the very first experienced some different conditions of ossification from those of the vertebral neural arch—supposing, of course, an anterior enlargement of the nervous system to have taken place prior to the entire segmentation of the notochord. Such a view, however, is not supported by the evidence from *Amphioxus*, since the notochord is segmented and no brain developed. And the difficulty of a theory of the skull hinges upon the relative probability of the skull originating prior or subsequently to segmentation of the notochord—because in the one case it will be but an extension onward of the vertebral plan, and in the other case it may have originated apart from the vertebral basis. If the *Amphioxus* is a distinct type animal from the Vertebrata, we shall not be warranted in reasoning from it to a vertebrate. But, whatever the initial circumstances were which governed the formation of a brain-case, we shall not be justified, except with good evidence, in assuming any other cause to account for it than potential repetition, which under altered conditions has been found competent to produce very different osseous structures in different parts of the vertebral column, especially as the brain offers a surface to be covered different from the spinal cord, and conditions of stability different from the visceral region. It has been seen, with the diverging vertebral processes, that, under the new conditions, osseous elements come into existenee which were not found in the caudal region: similarly it will not be surprising if some new structures are developed in the head by the special influences working in that part of the body.

Suggestive evidence of original unity of origin, direct or indirect, for the whole skeleton, is supplied by the skull being segmented, as it is shown to be by well-made researches; for if it had originated independently, no trace of segments could be anticipated, but an arrangement of bones with which the spinal column would have at first nothing in common, though eventually its potential energy would influence their arrangement, and gradually bring the structure of the brain-case into harmony with the vertebral plan. Thus there are three possible ways of formation for a skull:—1st, potential repetition of the vertebrate plan; 2ndly, independent ossification; and, 3rdly, independent ossification modified by potential repetition. The facts of the case are such that it is quite possible to select examples which would sustain each of these views. Thus among the shark tribe, the bony cerebral envelope is made up of homogeneous osseous particles which show no indication whatever of segmentation. And, in the absence of evidence of division of the head into separate bones, it would be an unwarrantable use of the imagination to suppose that the divisions had once existed and have become obliterated. This would seem to be a type of those examples of the skull which have originated independently of the vertebral column and before it extended the whole length of the animal. The serpent might be taken as a type in which the skull might have originated as a natural consecutive part of the vertebral system; while for the third type we might instance fishes like the sturgeon or animals like the Chelonians, where the brain is first sheathed in homogeneous cartilage which may have been formed independently of the vertebral system, then this is covered with osseous plates, which reproduce with some modifications the vertebral elements.

Thus there must always be a conflict between potential energy, in organization, leading to uniformity and simplicity, and kinetic energy, leading to variety; and the longer any type endures in time, the more closely its cerebral region will approximate to the vertebral structure, so far as the grouping of the bones is concerned; thus in the human subject the structure of the brain-case is more simple and the segments are better marked than is the case with fishes; so that a theory of the skull will depend upon the organization of the animal, which determines the relative influence of kinetic and potential ossification.

The human brain-case, being almost entirely a potential ossification, is one of the simplest. It consists of some (three) bones at the base, in the median line, called in sequence basioccipital, basisphenoid, and presphenoid, the basisphenoid and presphenoid in the adult being united together as one bone. The basioccipital immediately follows the centrum of a vertebra; and these bones are to the skull what the centrums would be to three segments of the vertebral column. On each side of this row of skull-bones are placed three other bones (a side bone to each base-bone), which rise up to embrace the sides of the brain. They are called (in sequence from behind forward) exoccipital, alisphenoid, and orbitosphenoid, and have the same sort of relation to the base-bones that the lateral elements of the upper arch of a series of three vertebræ have to the three centrums out of which they rise. In the vertebræ the upper bones, called neurapophyses, enclose the neural substance, meeting above it. In the skull they do not meet above; but just as with the lateral elements of the inferior vertebral arch, in the transition from the true caudal region to the preanal or visceral region osseous elements come to be introduced between them in some animals, which did not exist in the tail, so in the transition from the upper arches of the vertebræ to the upper arches of the skull, enlarged to cover the brain, a sequence of bones is introduced, to roof over the cavity, to which there is nothing corresponding in the vertebral region. These bones, counting from behind forward, are named supraoccipital, parietal, and frontal. And all the bones enumerated differ from those of vertebræ in touching each other throughout their lateral margins by sutures or overlap—a condition which in the vertebral column is only met with exceptionally, as in the cervical region of the rays, pipe-fish, &c., and a part of the vertebral column called the sacrum, in many land-animals. And these bones touching each other throughout their extent, enlarge the cranial cavity much in the same way as a sea-urchin enlarges its covering shell. In the human skull there is something more, however; there are bones which have existence in relation to the senses: such are some bones which come in between the first and second segments of the skull, and are connected in a more or less evident way with the ear; they have been named collectively the otic bones. Then, between the second and third segments, though external to them, is usually one bone or more, developed seemingly in relation to the eye: the lachrymal (and, perhaps, the malar) is such a bone. And in front of the brain there are bones which have relation to the nasal functions, and are named generally the ethmoid bones. In possessing these sets of bones the bony investing girdles of the brain differ in plan from the investing girdles of the spinal column.

If, now, we ask why there should be three segments in this bony box for the brain, and why not an indefinite number of segments as in the vertebral column, and why the structure of the skull should become simpler the higher we ascend in nervous organization, so that the three segments become more and more well defined, the answer is, that the division between the segments is maintained by senses which are not repetitions of each other, that the brain has a terminal sense anteriorly, and that by the bones touching each other on every margin, along all of which they can grow, there is in the skull an exercised facility for kinetic growth, which renders it impossible that potential growth should be manifested. If, for instance, a potential epiphysis of the frontal segment of the skull were to be formed, it could only be developed between that segment and the parietal segment; and it could only reproduce, to mark its division, a new pair of eyes behind the old pair. And it is impossible to conceive of such a change taking place except as the only way in which the energy of the animal could be manifested. While, therefore, the bones of each segment remain separate from each other, and permit growth within, it is impossible that any cerebral increase, supposing for a moment it were competent for such an end under any circumstances, could result in the formation of a new segment. Then (no matter how the mammalian skull originated), being segmented by the sense-capsules, it must ever have been subjected with greater and increasing influence to the potential power of the vertebral column, which will be manifested in bringing the plan of the segments of the skull more and more into harmony with the plan of the vertebræ, and so will obliterate any differences due to origin or number that there may have been, in an earlier condition, between the structures of the different segments.

Neglecting for the present the jaws of the potential skull and the whole question of the nature of the inferior arches to the segments, I would draw attention to the question whether the potential character is always an induced one.

In most sharks there is no differentiation whatever of the brain-case into constituent bones. In a specimen of the angel shark in the Museum of the Royal College of Surgeons, there appears on the base of the skull to be a faint indication of a transverse division. And it might be presumed that the segments would originate first, and then that each segment would put on the divided condition; but I doubt whether the tendency to potential increase is the same in the neural arch and centrum; for in many sharks the neural arch appears to be double, to have been formed originally at each end of the centrum, though often one of these arches has more the aspect of a supplementary arch introduced between two centrums; moreover the fact that in palæozoic fossil fishes the centrum is rarely ossified would lead us to anticipate that in the skull the base-bones would be the last formed and least well defined; so that in conceiving of a skull induced potentially upon the basis of a shark's skull, it would be quite consistent with the vertebrate plan to have a greater number of superior arches than of median base-bones.

But in those ordinary osseous fishes in which the several bones can be separated from each other, we find the skull in no transitional state, but already with the elements well defined, except at the base of the skull, where the kinetic ossification persists as a long median bone called the parasphenoid or basitemporal. And in the upper part of the skull, besides the three ordinary arches such as have been described, there come to be introduced three additional, imperfect arches, analogous to the intervertebral neural arches of sharks, and which I interpret as potential representatives of those structures. The first pair, in front of the frontal bones, are named the prefrontal bones, one on each side; the second pair are between the frontal bones and parietal, and are named postfrontal; the third set are between the occipital and parietal, and are named the interparietal bones: these latter only persist in the skulls of the higher Vertebrata.

It is to be remarked that in fishes the cranial bones overlap each other in the squamous way in which an ordinary zygapophysis laps upon its fellow.

And it appears to me probable that Prof. Owen truly appreciated the homology of the bones which roof in the skull when he compared them to the small ossification which often crowns the spinous part of the vertebral neural arch, which is by him named the neural spine, since without that ossification it would be more difficult to see why the lateral bones should not curve upward and roof in the cranium.

It is also worth considering whether in osseous fishes the potential growth may not have a direction, so to speak, given it by the influence of cerebral form, because it is observed, in skulls of equal size, that in *Lophius*, which has the cerebellum very short and small, the occipital region of the skull only measures 2 inches in length, while in the tunny, which has the cerebellum large, the occipital part of the skull measures 4¼ inches in length; so that, since some fishes (like the eels) have olfactory lobes to the brain almost as large as the cerebrum, it may not be impossible that such a condition in fishes may have had a tendency to promote differentiation like that seen in the separation of nasal bones from the prefrontal in some Chelonians.

Now, just as in the more osseous fishes the parts of the divided neural arch become blended, and the centrum becomes more solid, so in the higher Vertebrata the prefrontal and postfrontal bones have become lost under the uniformity induced by potential growth—if ancestors of such animals are considered ever to have had such bones.

This being, as I suppose, the mode of origin and plan of growth of the neural arches of the skull, I turn to explain the inferior arches.

In sharks the head is singularly instructive in the relation of the jaws to the skull; for there they are seen to be free structures which are merely appended to the brain-case. This condition, permanent in the shark, is embryonic in what are called higher Vertebrata.

The jaws are the entrance to the digestive canal; and therefore we must anticipate that they will be surrounded with bones which are the representatives of those which encompass the digestive organs in the region of the vertebral column, viz. of ribs. Prof. Rathke, describing the embryonic development of the jaws in serpents, records that "that part of the investing mass of the notochord in which the basisphenoid is developed in many animals sends out a 'ray' or band downwards on each side, which presents a remarkable similarity to a rib, not only in its mode of origin, but in its original position and form." "But very early there grows out from near the upper end of the ray a long thin process, which passes off at an obtuse angle to it, and applies itself to the inferior wall of the future brain-case." Now this condition is that of an ordinary rib of a fish. There is a long rib, as in mammals; but near its junction with the vertebra it gives off by articulation a long thin epipleural element, homologous with that of Crocodiles, *Hatteria*, Birds, &c.; so that I see no reason to doubt that the jaws are developed primarily as one rib, the epipleural elements of the two sides being directed forward and meeting in the middle line, so as to form the palate, and the ordinary pleural elements being directed downward so as to meet and enclose the digestive tube below. The ribs of fishes are simple; but in reptiles and birds and mammals they become segmented; and there appears to be no limit to the number of parts which may be included, while the degree of ossification is various. In some animals there are five parts.

In the serpent the epipleural element becomes segmented into the pterygoid, palatine, and maxillary bones; while the rib itself is divided into the quadrate bone proximally, then the articular bone, and then the elements of the lower jaw, which surround the cartilage and may number as many as five. The cranial representative of the rib always articulates with the squamosal bone.

It must at once occur to any one to ask, if the cranium consists of three segments, and only the middle one developes a rib, what has become of the ribs to the other segments? And it was the difficulty that there is in meeting this question in the higher Vertebrata, which led me (in a former paper*) to regard the occipital and frontal segments of the skull as standing in the same relation to the parietal segment as the epiphyses of a vertebra stand to its centrum. But remembering that, no matter what the potential power may be, it can only give great development to a structure when coincident with functional growth, we should no more be justified in anticipating ribs to all the cranial segments than to all the vertebral segments; and with many animals parts of the vertebral column will be devoid of ribs. Yet as the upper arches of the skull retain characters which long previously became lost to the upper arches of the vertebral column, so we might with more reason expect the lower arches to be present in the skull than in cervical or lumbar vertebræ. Accordingly, if we examine a skull, and remove all those bones which we have regarded as modified from a functionally developed rib (which we name the jaws), there will be found in front of their point of attachment, and under the frontal segment, two bones, named the vomeres; sometimes they become anchylosed into one median bone. And anterior to these bones, and bent up over them frequently, are the ethmoid bones, which similarly may become anchylosed. Thus we again have the representative of a rib with its epipleuron. By segmentation the ethmoid developes the nasal bones; and it is probable that by segmentation the vomer forms the premaxillary. Thus the anterior rib conforms in plan to the posterior rib, and, like it, embraces an organ which, in the lower animals, is only that of smell, but which, by potential growth comes, in the higher vertebrates, to be the respiratory region. So that, just as there are distinct tubes for breathing and for swallowing in the land Vertebrata, so distinct tubes are made for those offices in the skull by the prolongation forward of the dorsal respiratory tube till it is embraced by the first pair of cranial ribs, while the digestive tube, not prolonged so far forward, is embraced by the second pair.

It is not so easy to find the third pair; and only on turning to the fish is the homology evident. At each side of the back of the skull is a bone attached to the periotic bones, named the hyomandibular; and to this bone is attached in front the circle of hyoid bones; and attached to it behind are the opercular bones; so that there is again a forked rib variously segmented for the third arch.

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* "Outline of a Theory of the Skull &c.," Annals, 1866, xviii. p. 345.

With the termination of branchial respiration (and the branchial arches appear to represent the epipleural elements of cervical ribs) the function of the pleural element of the first cerebral arch appears to cease, and the bones of the operculum are no longer developed; and in the same way, when the respiratory function becomes changed, so that the animal breathes by lungs, the branchial bones are merged in the hyoid; the hyoid loses its heavy osseous character, and has a less firm attachment to the hyomandibular. This bone then gives attachment to the quadrate, and becomes the main support for the mandible; so that it appears to be the bone which among the higher Vertebrata is named the squamosal. In the fish there are bones in front of the quadrate bone which are called metapterygoid and symplectic. I have doubted whether these bones may not have originally stood in the same relation to the second visceral arch which the hyomandibular held for the first, since they persist, the metapterygoid becoming the quadrato-jugal, and the symplectic becoming the supraquadrate; and they both appear ultimately to be absorbed into the squamosal. If this view were taken, it would in no way be inconsistent with fact, and would only show that the lower jaw had been carried a stage backward, while it would explain the existence of two otherwise obscure bones, and justify their disappearance under the influence of potential growth in those animals in which they are wanting, since in the Amphibia is seen a similar lateral joining-up and absorption of the branchial arches into the hyoid.

Already it has been remarked that the lower jaw always articulates with the squamosal bone, the squamosal bone being, as we have just seen, apparently the proximal element of a visceral arch. Sometimes the squamosal bone itself is free, as in serpents; but usually it is firmly fixed in the skull. Sometimes, also, the quadrate bone is firmly wedged in the skull, as in Crocodiles, Chelonians, *Hatteria*, and most of the extinct Monocondylia; but there is no evidence whatever of any other part of the lower jaw (as the os articulare) being united with the skull. And in all those animals in which the quadrate bone is joined with the skull, the lower jaw remains composite. In the highest Monocondylia (birds) the quadrate bone remains distinct, while the squamosal bone has entered into the skull in the same way as in mammals, and furnishes a concave articulation for the quadrate bone exactly like that which in mammals is given to the lower jaw. Now, in so far as the lower jaw occupies the position of a rib, the influence of potential growth upon it would be to make it ever more and more like a rib in simplicity of structure: hence I presume that when, in the mammal, one continuous ossification joined up all the splint elements of the lower jaw, the os articulare and quadrate bone, as natural elements of the same rib, could be no exception, and that there is nothing more remarkable in this union than in any of the other transitions to simplicity and uniformity and order which are produced by potential growth.

And it may not be uninteresting to remark how much the vertical part of the lower jaw in any herbivore reproduces of the form of the quadrate bone in such an animal as a bird, and how the inflection of the lower jaw in marsupials and rodents reproduces such an inflexion as characterizes the os articulare in birds and many reptiles. These growths in the mammal may, I conceive, be potential repetitions. In the mammal the pterygoid is moderately developed and is directed downward posteriorly, and not backward as in birds and lizards; so that it does not actually meet the representative of the quadrate bone; but the union is kept up by the pterygoideus muscle, attached from the outer inferior side of the pterygoid to the inner side of the quadrate portion of the lower jaw.

I am aware that Prof. Huxley has supposed that, contrary to all analogy, the quadrate bone and os articulare enter the mammalian cranium and become the malleus and incus. After reading all that has been said for that doctrine, I can see no evidence in its favour sufficiently strong to dissuade me from stating my own view. If it has been important to construct those bones out of pre-existing cranial elements, I would suggest that Prof. Huxley might have taken the quadratojugal and symplectic, which were available and would have answered equally well. But I do not think any exigency of theory can justify the creation of a new joint in the body by imagining a convex articulation beneath the articular bone, when there is nothing in the vertebrate province to suggest that such an articulation might exist.

Such, divested of details, is the conception of the common plan of the axial skeleton which, by the operation of the laws of organic energy, may, I believe, call all skeletons into existence, extending them over the viscera like a pillow-case over a pillow, till the animal is gradually but inevitably sheathed in rings of bones. And thus it will be remarked that the preexisting soft animal would have no necessary correlation of soft vital parts with its osseous sheath.

I touch with reluctance, because of its difficulties, on another part of the skeleton, which seems as though only appended to the vertebral column, already discussed by Prof. Owen, in his treatise on limbs, and by others. Each limb consists of a sequence of bones, of which the number of parts in each segment in most animals increases from above downward, and is usually the same, part for part, in the fore limb and in the hind limb. Thus in the first segment there is one bone, the humerus or femur; in the second segment two bones, the ulna and radius or the tibia and fibula; in the third segment three bones, in the proximal row of the carpals or tarsals; in the fourth segment four bones, in the distal row of the carpus or tarsus; and in the fifth segment the five digits. Variations occur in great number, but chiefly by suppression of parts; and so true is the correspondence in general, that Professor Humphrey offered an interpretation of the structure by supposing that there were originally in each limb five rays, which in the humerus are blended into one, while in the phalanges they remain more frequently distinct.

It will be necessary to ask, what are these limbs, and in obedience to what mechanical law are they where found, and why do the fore and hind limbs correspond in their parts?

But, besides the limbs, the skeleton possesses the arches with which they articulate:—for the hind limb a pelvis, made up of an ilium, ischium, and a pubis; and for the fore limb a scapular arch consisting of a scapula and coracoid, and sometimes having associated with it a clavicle and interclavicle.

If we turn to comparative anatomy for an explanation of the phenomena, in sharks and rays the pectoral and pelvic regions will be found to be well developed, and long limbs are attached to them which are already well segmented and limited at the sides to fore limbs and hind limbs. In osseous fishes, however, the fins represent, as a rule, more than two pairs, and are often strongly developed down the back. So the first difficulty is, why should there be but two pairs of limbs? To that question, perhaps, an examination of a skeleton will furnish an answer; for the two arches will be seen to be at the two ends of the primitive soft animal enclosed by the skeleton, and at the two chief points of flexure of the skeleton—one where the neck bends with the body, the other where the tail bends with the body; and in those animals in which there is little or no special flexure in one part more than another, limbs are wanting, the potential tendency to the development of limbs nevertheless notwithstanding. Now if we can discover why they are wanting, we obtain a clue to their law of development.

In serpents the power expended in motion is distributed equally along the whole body, and there is scarcely greater pressure in one part than in another; so that its influence upon growth is only seen in the great length of the ribs. Now, if the body were stiffer in the middle, and flexible chiefly in the neck and tail, then, instead of intermittent pressure being distributed uniformly, it would be manifested chiefly at the two extremities of the stiffer part, which, touching the ground, would be lifted by the movements of the head and tail. If, then, a large part of the pressure and tension which, distributed over the body, elongate the ribs of Ophidians, were accumulated in this or some such way (by movement of the body) at these points, whatever osseous structures pre-existed there would grow; and potential growth would tend to make the parts at the anterior end of the body correspond with those at the posterior end. What parts, then, would there be existing in such places? Clearly some element of the abdominal rib—elements, it may be presumed, which become the coracoid bones and the ischia. As the ribs become segmented into a number of parts in different animals, it is not easy to guess how many were developed; but as the facts of the case only require two (coracoid and scapula, and ilium and ischium), these may be presumed to be the second and third segments of the rib. Now the consequence of setting up a special tendency to grow in these elements can in no way interfere with the growth of the original rib, which, being joined to these hæmal elements by overlap and by muscles, would, I suppose, slide over the outside of these new growths, which would extend inside of it. And I should regard the epipleuron as eventually forming the clavicle and the pubis, while the suprascapular is an effort of potential growth to reproduce the original rib from which the arch-elements have become detached.

But how account for the limbs? Did they spring into existence ready formed, or grow gradually? and, in either case, how? I cannot but be impressed with the forked character of the limb, dividing in its second segment, as reproducing the forked character of the visceral arches of the cranium and of the vertebræ; and therefore I believe that, in the absence of any other evidence of a distal osseous fork, we can only look for the proximal element of a limb in the proximal element of a rib. And so I conceive that the increased muscular power of the pectoral or pelvic girdle might detach the proximal part of the rib from its attachment with the vertebra and draw it on to the already expanded hæmal elements—and that potential growth, such as reproduces the lizard's tail and the salamander's legs, would cause its distal segments to be developed anew at the distal end, although the proper distal segments now gave attachment to the proximal end. With the bone would necessarily follow the muscles; and potentially added segments would comprise both hard and soft parts. In the absence of evidence, I can only throw out this idea as completing a conception of the skeleton as a whole. It explains the origin of limbs simply as a modification of pre-existing structures, without calling any new part into existence; it explains the harmonious segmentation of fore and hind limbs, and the increase in number of bones in the successive distal segments (as well as the primitive separation of the arches from the vertebræ), which are the fundamental points of structure in a limb. And no idea of epigenesis from the arches, as suggested by Professor Owen, could justify either one condition or the other. The only other obvious origin for the limbs is by potential growth repeating the structure of the jaws with their segments upon each of the arches, first on the pectoral and afterwards on the pelvic arch, which is simple and so far a preferable view. And if the limbs were regarded as potential jaws, the fact that there are thus two modified appendages to the body may explain why the three segments of the brain-case have only one functionally developed hæmal arch, the other two, by potential growth, being removed to the pectoral and pelvic arches.

This conception of the skeleton as originating in a single ossification, and attaining all its complexity by growth in a definite direction, which is sustained by laws coextensive with the universe, and modified in the limbs by the circumstances of existence, has a unity of plan, and gives a reason for every variation which it displays. And if we believe that animals have been changed in form and stature by the continuous operation of those laws of energy which, by changing the minutiæ of every thing that cognizance extends to, preserves for them uniformity, order, and progress, then such small variations from this common plan as give the distinctive marks to each group of animals are themselves but an evidence of the larger range of those laws which give the animal its unity and one harmonious government with all things. Because this unity is incontestable, I believe in this change as a condition of its stability; but whether it is named creation or whether it is named evolution, no name can extinguish the unbounded harmony of the relations which it exhibits, or the unvarying order in the changes to which names are but paths, or can part a knowledge of the universe in its government from an unutterable and reverent confidence. For to me it indicates, beyond laws and their consequences, what, judged by human standards, is Intelligence, of which laws in their working are manifestations. If, then, an attempt is made to explain the plans of animal life, it is in faith, born of science, that they are products of divine law, and in a conviction of duty to seek out its working in all ways.

The scheme of the skeleton now sketched is what may be named a potential skeleton; and whatever value it has is in the insight it gives into the relations to each other of the parts of skeletons and the importance of resemblances between similar parts in different skeletons as evidence of genetic relation. All the types of vertebrate animals are based upon this general plan, and each differs from the other in some comparatively slight details of potential growth; and there is nothing peculiar in the genera referable to each of these minor types except a varying growth, or suppression of growth, or combinations of growths in the different bones of the body: such modifications are the kinetic skeleton. If we find similitudes between bones when they are compared together, the comparison becomes meaningless and unprofitable unless we believe the similitudes to be consequences of laws which can be traced in their effects. The idea of affinity expresses faith in such laws by teaching that the structural resemblances between animals are a consequence and evidence of an original community of plan now only seen in fragments. And an original common plan for vertebrates, a potential skeleton, implies that the physical laws of nature producing growth have upon their simpler product acted in differing ways, so that the energy of the type became manifest in the divergence of special different parts which make the plans of the several vertebrate classes.

Hence the practical question, affecting all comparative study, after the mind has cancelled whatever osteological structures are variable in the type (and therefore demonstrably kinetic), is to discover in what direction each order has diverged from the common plan, and in what way this diversity obscures or renders clear its affinities with the other orders. To put a special case:—in what direction relatively to the vertebrate common plan is the osteology of a tortoise developed? and how far from this osteology can we infer a community of divergence between the tortoise and all other or any other known animals? Those points of divergence in the potential skeleton would be the osteological affinities of an animal, and, determined for a number of known types, would enable us to predicate within approximate limits the characters of many extinct orders of which the existence is at present hardly suspected.

To examine such a problem, it is necessary to be familiar with the facts which are factors in it; and so to these we must next turn.

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the resemblance between the different groups of reptiles, for instance, is a correspondence of homologous parts, and no evidence of the orders having had an immediate parentage in common. Such a doctrine invites investigation. Here I can but state it, and try to show hereafter in what way such portions of it as practically concern the student of reptile bones may be profitably studied.

IV.—*Proposed Name for the Sponge-animal, viz. "Spongozoon;" also on the Origin of Thread-cells in the Spongiadæ.* By H. J. Carter, F.R.S. &c.

As it has now been satisfactorily determined that the Spongiadæ are animals and not plants, and the form of the animal which produces them has also been determined, it becomes necessary to give that form a specific name, and to define the animal, in order that henceforth both may not only be used by the zoologist, but by the comparative anatomist, whose lectures without such additions now cannot be considered complete, the time having passed for the comparative anatomist and the botanist to dispute respecting the kingdom to which this class of beings may belong.

The name that I would propose for this purpose is "spongozoon," which is only the Greek rendering of "sponge-animal," but retaining "sponge" for the root will ever ally it to the Spongiadæ, and thus aid the memory by associations which any other term differently compounded would not do.

Spongozoon, or the sponge-animal, then, I first pointed out in *Spongilla*, in 1857 (Annals, vol. xx. p. 28, pl. 1. fig. 4), wherein it is shown that it is a granuliferous polymorphic body possessing a nucleus and one or more contracting vesicles (p. 30), that it exists in communities of a spherical form with a common circular aperture (figs. 2, 3, 5), in countless numbers, in the sarcode of the sponge (fig. 1), and that it is capable of taking into its body crude material and of discharging the undigested portions after the manner of *Amœba*; lastly, that the circular aperture opens and closes itself as required.

Then, in 1859 (Annals, vol. iii. p. 14, pl. 1. fig. 12), the same monociliated body is described and figured with two ear- or spine-like points of its sarcode, one on each side the cilium, which, I might also add, *now* stands in my journal as it was figured "Aug. 12, 1854," although not published until 1859; and that I had been previously acquainted with the existence of the spines may be seen by the following passage in the paper to which I have last referred, viz.:—"But there is one [monociliated body] in particular, which has two spines or ear-like points projecting backwards, one on each side of the root of the cilium (pl. 1. fig. 12), and this was the kind which I first discovered and described; but, confounding it with cells not possessing these spines (because I then thought the spines might be accidental prolongations of the sarcode), I did not give it this character."

That I might have been right in this conjecture, the polymorphic nature of the whole of this body will presently show.

In June 1866, Prof. James-Clark read a paper before the Boston Natural-History Society "On the Spongiæ ciliatæ as Infusoria flagellata, &c." (Mem. vol. i. pt. 3, reprinted in Annals, Feb. 1868), in which (p. 21, footnote) he conceives that the two spines or ear-like points represent the lines *en profile* of a "membranous cylindrical collar" which he had observed to exist round the cilium of the monociliated cell in *Leucosolenia botryoides*, of which most satisfactory delineations are given in his plate 1. figs. 41–44, together with that of several species, fluviatile and marine, of similar animals that live independently in groups or singly, sessile and pedicelled, respectively, apart from the sponge altogether. In the latter Prof. James-Clark most sagaciously demonstrates the existence also of this "membranous collar"—observations which have been further confirmed as satisfactorily by Mr. Kent's descriptions and delineations of several of the same kind of Infusoria that he found in a pond at Stoke-Newington, in the neighbourhood of London (Monthly Microscop. Journal for Dec. 1871, p. 261, pl. cv.).

Returning, however, to Prof. James-Clark's "footnote," he adds, "that Carter did not always find these 'two spines,' may be explained by the fact that the membranous collar, as I am inclined to believe the 'spines' to be, was retracted, since I have frequently observed this to happen in the case of *Leucosolenia* when it was disturbed."

That is as much as to say that the "collar" is polymorphic; and herein is the explanation of what I have above quoted from my paper of 1859, viz. that "I then thought the spines might be accidental prolongations of the sarcode,"—a fact which is still further confirmed by my paper of 1871 (Annals, vol. viii. pl. 2. figs. 17 & 18), wherein it is not only stated that every part of the sponge-animal is polymorphic, but the "collar" itself in the figures mentioned may be observed to be transformed into two pseudopodial tentaculiform processes for seizing particles of food, like those of an *Actinophrys* or of an *Acineta*.

Hence the "collar" may be cup-like around the base of the cilium, transformed into pseudopodial prolongations, or, as Prof. James-Clark has stated, "retracted" altogether.

In 1871 (Annals, *l. c.* pl. 1. figs. 15, 16, &c.) I not only confirmed Prof. James-Clark's observations respecting the existence of the "collar," but found that in the spongozoon of *Grantia compressa* it was supported on a neck-like projection, to which I gave the name of "rostrum." Moreover it was also proved, by the use of indigo-solution, that the spongozoa of this sponge took in crude particles of this substance, while similar monociliated bodies similarly grouped were also observed in the marine siliceous sponges; to which I can add one of the horny species *par excellence*, viz. an *Aplysina* (Nardo & Schmidt), now belonging to the British Museum, but which Mr. Kent lately found while dredging for sponges on board the yacht 'Norna,' in Vigo Bay.

Thus having found spongozoa in all the three divisions of the Spongiadæ, viz. in the Keratospongiæ, the Siliceospongiæ, and the Calcispongiæ, similar in form and similarly grouped, we may reasonably infer that the spongozoon exists as such, perhaps more or less modified, throughout the whole of the Spongiadæ, and therefore is *the* animal which constructs the sponges generally.

In Silliman's Journal for Dec. 1871 (reprinted in Annals, vol. ix. p. 71, pl. 11) Prof. James-Clark confirms, so far as his observations go, the principal points of my description and figures of the "Ultimate Structure of *Spongilla*," given in the 'Annals' of 1857 (*l. c.*), to which I have alluded in the first part of this communication.

But at p. 76 (Annals, *l. c.*), where Prof. James-Clark states that the groups of "monad cephalids" (our spongozoa) are "not cells; they are the *heads* of a polycephalic individual, and consequently correspond functionally to the tentaculated heads of polypi," I cannot agree with him, inasmuch as they appear to me to be much more analogous to the groups of Ascidians in the gelatinous structure of a Compound Tunicated animal, where the little colony is divided up into groups, furnished respectively with a common cloacal orifice (Annals, vol. viii. pl. 2. fig. 41). Here I might add that some of Schmidt's Halisarcinæ are so like the Compound Tunicata, that his *H. guttula* appears to me to be one of the latter, and no sponge at all. I speak, of course, from the actual examination of his specimen in spirit at the British Museum in connexion with his published description.

Further, Prof. James-Clark does not admit the existence of a *distinct* cell round the groups of spongozoa, as I originally described and figured them as a whole under the name of "ampullaceous sac" (Annals, 1857, *l. c.*), but that the groups are situated in excavations of what I termed, in 1849, the "intercellular substance" (that is, in "mere cavities," having "no lining wall," Annals, 1872, *l. c.* p. 76), but opening into the chamber which I have delineated between the "investing membrane" and the "parenchyma" (fig. 1, 1857, *l. c.*), Professor James-Clark's "cytoblastemic mass."

All that I can state in reply to this is, that I have figured faithfully (*l. c.*) what appeared to me to be the rim of a circular opening in material belonging to the spherical group of spongozoa. Furthermore, in my journal, under date "26th March 1857," stands a figure of one of these spherical groups of spongozoa which I well remember to have observed in the watch-glass *by itself*, with the cilia still vibrating in its interior and the aperture closed, after that state had arrived when, as I have described (p. 29, *l. c.*), the whole of the soft parts of the young *Spongilla*, apparently from starvation, leave the spicular structure and become dispersed about the watch-glass.

That I did not figure this cell I also well remember to have arisen from diffidence on account of the great number of new and startling facts that were then revealed to me.

Of this being fact, I now have no longer any doubt; and thus we had an "ampullaceous sac" entirely isolated from the parenchyma ("cytoblastemic mass," Prof. James-Clark) of the sponge, that is, by itself in the watch-glass.

With no aperture, it is true; but then we know that this can be closed or opened as required: yet it still retained the globular form; and hence the question then comes, whether this globular form was retained by an intercellular substance or sarcode uniting the spongozoa together, or whether this union arose from an amalgamation of the polymorphic sarcode of which their bodies are respectively composed. I incline to the former; and this is what I should designate as the "ampullaceous sac."

But here we arrive at a point which is most perplexing, if it be not almost entirely beyond our powers to decide,—viz. that state in which the living material assumes forms so delicate and so fugitive that we are inclined to deny to them characters even in a remote degree of that solidity and permanence which by comparative coarseness becomes so evident to our senses in the more advanced developments of ordinary tissues.

In short, are we to deny the existence of a cell of intercellular substance binding the whole of the spongozoa into a spherical community, or not? And if so, where is the proof that this spherical form is maintained by the spongozoa uniting together without the intervention of this substance?

This brings me to another point which I wish particularly here to clear up.

In Prof. James-Clark's footnote (Annals, Jan. 1872, p. 76) it is stated that "he [Carter] has since (viz. in the Annals of 1859, *l. c.*) revoked that view and adopted another. We believe him to be, excepting the inferred 'ampullaceous sac,' in the main right in his first interpretation"—that is, of 1857.

Had Prof. James-Clark chanced to have looked on to my "Notes and Corrections" (Annals, 1861, vol. viii. p. 290), two years afterwards, he would there have seen that which he himself has stated, viz. that I myself *then* felt right in my interpretations of 1857.

Time and subsequent observation have explained how all this revoking occurred. The whole has arisen from the polymorphic ever-changing nature of the soft parts of the sponge. What I saw at first was changed upon my second observations; and I saw in the third set again what I had proclaimed in the first and denied in the second. In the higher developments there is no dispute as to the nature of structures, because they are permanent and evident; but in the ever-changing sarcode phenomena are exhibited which certainly, in our present state of knowledge, are inexplicable; and the very difference of opinion respecting them to which I have above alluded proves at once that we have as yet no certain data to go upon for any assertions respecting them. What is a mass of sarcode at one moment may be at another in the form of a membrane so delicate as almost to be inappreciable by our senses, and at a third reappear in the form of pseudopodial prolongations. Nay, in *Æthalium* the sarcode may be seen to divide into separate portions and reunite into one mass, apparently as intimately as drops of water.

Finally, I have to describe Spongozoon.

It may be defined to be a spherical polymorphic body or cell, bearing on one part of its circumference an oblong cylindrical neck-like process, called the rostrum, which supports a delicate cup-like collar, from the centre of which proceeds a long cilium. Internally it contains granular plasma, in which are imbedded a nucleus and one or more contracting vesicles. It possesses the power of taking in crude material for food, and exists in spherical or globular communities imbedded in countless numbers in the sarcodal lining of the areolar cavities of the sponge. Each of these spherical communities is provided with a circular contractile opening on the surface, through which the particles of food enter, to be further taken in by the monociliated bodies which, in juxtaposition, line the interior and, projecting their cilia inwards, keep up a rapid undulating vibration towards the centre of this hollow sphere. The undigested parts of their food may be seen to pass into the excretory canals, and, through them, to be finally ejected at the vents on the surface; but whether it passes through their bodies after the manner of *Amœba*, or has a distinct channel appropriated for this purpose, has yet to be determined.

Parasitic Polypes and Thread-cells in the Parenchyma of a Sponge.

In a specimen, about two inches long, of a thick digito-lobulate branched *Reniera*, tubulate, opening by a large vent at the end of each lobe, and having one form of spicule only, viz. thin, curved, acerate, said to be of a "pale red colour when alive," and found in "Bon Bay," in "25–65 faths.," just sent to me by Prof. Wyville Thomson, I have found the parenchyma interiorly to be charged with thread-cells of an ovoid form, almost elliptical, and averaging 3-6000ths of an inch long by 2-6000ths of an inch broad—in short, very similar to, if not exactly like, that delineated by Dr. T. Eimer viii/ (Schultze's Archiv für mikroscop. Anatom. vol. iii. pt. 2, fig. 1, A, p. 283).

Not having found these cells in the dermal part of this sponge, nor in the surface-layer of the great tubular vents, analogous to their position in the polypes &c., but, on the contrary, in the interior of the parenchymatous structure of the sponge, I began to think that they could not belong to it; so I placed a portion in water and examined it with one-inch focus, when they were observed to come from minute delicate polypes, seated in dilated cavities, apparently of the excretory canals, the disk or head of each polype averaging 100th of an inch in diameter, and supported on a short neck, which ended in a little saccular prolongation that was sunk into the parenchyma or sarcode of the sponge, and charged, in its walls as well as tentacles, with thread-cells so numerous that they appeared to exceed in bulk the rest of the polype, as may be seen by picking out one on the point of a needle, and putting it under a higher power.

This is the first instance, I think, in which a parasitic polype has been discovered in the *interior* of the substance of a sponge; and when it is remembered that a microscopic power with delicate manipulation under water is required for their detection, it may perhaps be assumed that this is how polypes escaped Dr. Eimer's notice, and may also explain how he found thread-cells in *Reniera fibulata* and *Desmacella vagabunda*, seeing that many thousands of microscopical examinations of the Spongiadæ have been made by different naturalists up to this time without their observation.

The Renierinæ are especially subject to surface polype parasites, and none more so, perhaps, than *Reniera fibulata*, Sdt., all over the world. (This species is characterized by two forms of spicules, viz. (1) acerate, curved, smooth, large, and (2) C- & S-shaped, minute.) But I have never before found a parasitic polype in the interior of a *Reniera* or any other sponge, and never any thread-cells where there were no parasitic polypes to originate them. Nor should I have been able to detect them now but for the process mentioned.

There is also another jar sent me by Prof. W. Thomson, in which there is a portion of the same sponge with three other small fragments of as many species undescribed; but this is labelled "Adventure Bank, 92 faths."

"Bon Bay" is on the African coast, opposite Cape Spartivento (Sardinia); and "Adventure Bank" is the shoal between Tunis and Sicily.

Prof. Thomson also adds the following interesting information respecting thread-cells, in a note just received:—

"Thread-cells are abundant in every thing which feeds upon Cœlenterates of any kind, young or mature, whether feeding by cilia or by the mouth. I have found the thread-cells of several Hydroids apparently living in the skin of a *Synapta*; and you can always find plenty of them in *Amphidetus*. Of course, if you find a parasitic polype in the sponge, there is no further difficulty; but that does not seem necessary. Thread-cells appear to be able to live, for a time at least, an independent life in foreign quarters."

June 17, 1872.

V.—*On my so-called* Globiocephalus Grayi.

By Dr. HERMANN BURMEISTER.

In the new 'Journal de Zoologie,' the editor, Prof. Paul Gervais, of Paris, has noticed (tome i. p. 68) the descriptions of Cetacea published by myself in the 'Anales del Museo Público de Buenos Aires,' tome i. p. 367 *et seqq.*, and has hinted, with good reason, that the animal described there as *Globiocephalus Grayi* is not a *Globiocephalus*, but a *Pseudorca*, nearly allied to, if not identical with, *Ps. crassidens* of Prof. Reinhardt (Overs. Kongl. Danske Vidensk. Selsk. Forhandl. 1862, p. 103 *et seqq.*), comparing my figures given on pl. 21 of the 'Anales' with those of the 'Ostéogr. d. Cétacés,' pl. 50, published by himself two years ago.

As the sixth part of my 'Anales,' wherein is to be found the description of *Globiocephalus Grayi*, was published in the year 1869*, I could not compare the excellent figures of the 'Ostéographie' during the elaboration of my treatise, because the part of M. Gervais's work alluded to did not reach Buenos Ayres until Sept. 1870. I had at hand no other scientific works than Cuvier's 'Ossemens Fossiles' and Gray's 'Catalogue of Seals and Whales,' as I have already said in the 'Anales,' p. 369. Even Prof. Reinhardt's extended description was not known to me until after the printing of my 'Anales.' Occupied with the elaboration of the following parts, I could not find time to compare my previous labours with the new publications; and although, in Sept. 1870, I had seen the cited figures of M. Gervais, and recognized my error, I could not at once undertake the careful comparison of them with my own, as I was so much engaged with other labours which it was necessary, for various reasons, to complete. But now the criticism of M. Gervais has obliged me to do what I have hitherto neglected, to compare the cranium of *Globiocephalus Grayi* in our museum with the figures of his work, and to publish the results of this comparison.

From my new examination there can be no doubt that my *Globiocephalus* is a true *Pseudorca*; but I am also convinced that the species from Buenos Ayres is not identical with *Ps. crassidens*, but a new one, more nearly allied to *Ps. meridionalis*, Flower (Proc. Zool. Soc. 1864), than to the species of the European seas. My opinion is founded on the following reasons:—

1. The whole skull is narrower before than that of *Ps. crassidens*, and resembles more in the general figure that of *Ps. meridionalis*, with the exception of the tip of the muzzle, which is somewhat broader in my skull, and more nearly allied in its form to that of *Ps. crassidens*.

2. The right intermaxillary bone is much longer posteriorly than the left, surrounding there the outside of the nasal bone, nearly in the same manner as in Gervais's fig. 1. pl. 50. This character is not well indicated in my fig. 3. pl. 21, because the tip of the right intermaxillary bone of my skull has been broken off, which I had not noticed before I saw the figures in the 'Ostéographie.'

3. The two small faces of the maxillary bones, immediately before the nostrils, are of the same unequal size as in *Ps. meridionalis*, the right being larger and broader than the left. In *Ps. crassidens* both are smaller and of nearly equal size.

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* The copies of this part of my 'Anales' were sent from here to London Oct. 25, 1869, and to Paris Nov. 12, 1869, by the post-steamers.

4. The nasal bones are of very different form, without the high knob behind, but each with a deep diagonal furrow, which divides them into two faces.

5. The tip of the united parietal bones, with a prolongation going in between the frontals, is not pointed as in *Ps. crassidens*, but broad and truncate as in *Ps. meridionalis*.

6. Both the upper and the under jaw have the same number of *nine* teeth, of which the first in the upper jaw is much smaller than the others, but the last of equal size with the preceding ones. This character does not agree with the other species; both have one tooth more in the under jaw than in the upper jaw. *Ps. crassidens* has eight teeth above and nine below, and *Ps. meridionalis* nine above and ten below, the first of the upper jaw of this species being also much smaller than the following ones.

This difference seems to me to be of great importance, and alone sufficient to prove the distinctness of my species.

7. The vomer is visible between the upper maxillary bones in my skull, but not visible in *Ps. meridionalis*.

8. At least the form of the teeth is entirely different from that in both the previously known species; neither of them has the teeth so thick, short, and worn as my species from the Patagonian coast.

For all these reasons I believe I am quite justified in separating this animal as a distinct and new species from *Ps. crassidens* and *Ps. meridionalis*, naming it now

Pseudorca Grayi.

As I have given a comparative description of the skull in the 'Anales,' and also added the measurements (p. 373) on the metrical scale, I will not here repeat the same, but add only the principal measurements of the skulls of the three species in English inches, in the same manner as they are given by Gray in his 'Catalogue of Seals and Whales,' pp. 290 & 294.

	Pseudorca crassidens.	*Ps. meridionalis.*		*Ps. Grayi.*
		Adult.	Young.	
Entire length	23–24	23¼	20¼	26
Length of nose	12½	11¼	9½	12
Length of teeth-line	10	9¼	8¼	10
Length of lower jaw	21	19	16¼	21
Breadth at notch	8½	7¼	6¼	9
Breadth at middle of beak	8	5¾	5¼	8
Breadth of intermaxillaries	5⅙	4½	3¾	5¾

These measurements prove that the cranial part of the skull is relatively somewhat larger in *Ps. Grayi* than in *Ps. crassidens*, and that the whole animal may have been consequently stronger and stouter than the European species, exceeding the Australian one still more in both qualities.

The description and figures of the swimming Delphinide, seen by myself in the Atlantic Ocean and published in my 'Anales,' p. 368, do not belong to the *Pseudorca Grayi*, as I supposed, but to a true *Globiocephalus*, which cannot be determined exactly without further observations.

Buenos Ayres, April 24, 1872.

VI.—*On* Emys nigra *from Upper California.*

By Dr. J. E. Gray, F.R.S. &c.

Emys nigra of Hallowell is said to be the same as *Emys marmorata* of Baird and Girard, which Agassiz, in his great work on the Natural History of the United States (of which only the general observations and the tortoises have appeared), refers to the genus *Actinemys*, and figures the young of the species; and on his authority (for I have never been able to see the species) I have arranged it under *Geoclemmys* (see Cat. Shield Reptiles, Suppl. p. 27).

In Hallowell's Report on the Reptiles collected in the Survey for the Railroad from the Mississippi to the Pacific Ocean, 1859 (a work which I had not previously consulted), he describes and figures *Emys nigra*, which he says is very abundant in Posa Creek, northern part of Upper California. The figure represents a very depressed water-*Emys*, with a dark narrow band across the eye, broad webbed feet, with acute elongated claws. The head appears to be covered with a uniform skin, not divided into symmetrical plates. The limbs and tail are marked with large black spots; and the upper part of the head and neck is blackish, with numerous small yellow spots.

The skin of the head and limbs more resembles that of the true Terrapins than any other American species I know; and it would be very interesting to know the form of the jaws. It certainly is a purely aquatic tortoise, and has nothing to do with the more terrestrial tortoises of America forming the genus *Geoclemmys* or *Actinemys*.

Mr. Hallowell's figure is very like a specimen that I obtained at Nantes, and which I described and figured as *Emys olivacea* in the 'Catalogue of Shield Reptiles,' p. 30, t. 12 *c*, and which is named *Redamia olivacea* in the Supplement to that Catalogue, p. 35.

The specimen only differs from Mr. Hallowell's figure in being marked with brown lines beneath, and in having more elongate claws; and I strongly suspect that they are both the same species.

VII.—*Experimental Researches upon the Position of the Centre of Gravity in Insects.* By Félix Plateau*.

The study of the conditions of equilibrium of living creatures, I need scarcely say, is only possible when we know in each of them the situation of the *centre of gravity*. Now that the knowledge of the mechanics of the Articulata has made considerable progress, thanks to the employment of processes of investigation borrowed from physics, it seemed to me that it would be really useful to describe an easy method of investigating the centre of gravity of the Articulata, and to give an account of the results which its application to insects has enabled me to obtain.

Unfortunately I cannot, in a mere summary, give a description of the instrument I have employed. A mere short description without a figure is of necessity obscure and of no use at all. I shall only say that this instrument nearly reproduces, on a small scale and with some improvements, that which was invented by Borelli to determine the position of the centre of gravity in man. As to the results of my experiments, I must likewise refrain from giving them under the form which they take in my memoir—that is to say, in the shape of a considerable number of figures brought together in several tables. I shall therefore confine myself to the indication of the general conclusions which I have thought I might deduce from them, supporting these, where necessary, by a few examples.

1. The centre of gravity of insects is situated in the vertical median plane which passes through the longitudinal axis of the body.

2. It occupies a very nearly identical position in insects of the same species and of the same sex in the same attitude.

3. It is rarely that the external form of the body allows us to determine, *without experiment*, the exact position of the centre of gravity. I shall cite, as an example, the results furnished by the family of the Odonata. All its representatives have nearly the same external aspect; and yet, notwithstanding this quasi-identity of structure, I have found the

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* Bibliothèque Universelle: Archives des Sciences Physiques et Naturelles, tome xliii. 1872, from an abstract communicated by the author.

following differences in the relative positions of the centre of gravity:—

Agrion puella ♀. First third of the third abdominal segment.
Agrion sanguinea. Posterior margin of the second abdominal segment.
Libellula conspurcata ♀. Posterior margin of the metathorax.
Libellula vulgata ♀. Furrow between thorax and abdomen.
Cordulia metallica ♀. Posterior margin of the metathorax.
Æschna grandis ♀. Middle of the second abdominal segment.

4. The centre of gravity does not occupy the same position in the two sexes of the same species; it is sometimes more and sometimes less backward in the females than in the males, and its situation depends upon the relations existing between the various dimensions of the individuals.

It might have been supposed that the centre of gravity was always situated further back in the females, the abdomen of which is generally more voluminous than that of the males. I have observed the opposite condition in the females of *Oryctes nasicornis*, *Libellula vulgata*, and *Agrion puella*.

5. During the metamorphosis of the larva into the perfect insect, the *relative* centre of gravity approaches the head; the *absolute* centre of gravity, on the contrary, departs from it*.

This apparent contradiction is easily explained. The thorax of larvæ is generally very much reduced and the segments of the abdomen numerous. The centre of gravity therefore falls inevitably in an abdominal segment. In the perfect insect the thorax has acquired considerable dimensions, and the number of abdominal segments has diminished. The thorax, thus being more prolonged posteriorly, has advanced, in a manner, to meet the centre of gravity, which remains plainly in the median region of the body; and the abdomen becoming shortened, the distance from its extremity to the point in question diminishes.

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* In my memoir I have given the name of the *relative position of the centre of gravity* to its position with relation to some one of the parts of the body (segment, coxa, &c.), and that of the *absolute position of the centre of gravity* to the number which is obtained by calculating the relation between the distance from the centre of gravity to the posterior extremity of the body and the total length of the animal. The quotients 0·50, 0·67, for example, obtained in this manner, signify that the distance from the centre of gravity to the posterior extremity is *five tenths* or *sixty-seven hundredths* of the length of the body. They show at once, and independently of the form and extent of the segments, whether the centre of gravity is at the middle of the insect, more approximated to the head, or nearer to the anal orifice.

6. In standing, the centre of gravity is placed at the base of the abdomen, or in the posterior part of the thorax, and usually at the middle of the length of the body.

7. In walking, the centre of gravity of an insect is constantly displaced around a mean position, but by too small an amount to be capable of measurement.

In fact, if we make experiments by means of Saltatorial Orthoptera (locusts or grasshoppers), we find that the movements of their enormous posterior limbs induce changes in the situation of the centre of gravity; but these changes being very slight, we arrive at the conclusion that it would be impossible to measure them in ordinary insects.

8. We do not detect any displacement of the centre of gravity when an insect passes from the position of repose to that of flight, except in those species in which the wings are decumbent or crossed upon the back in a state of repose. The displacement is horizontal and from behind forward. For example, this displacement is as follows, in the following species:—

Dytiscus dimidiatus	0·045	of the total length	of the body.
Hydrophilus piceus	0·028	"	"
Melolontha vulgaris ♀	0·053	"	"
Notonecta glauca	0·032	"	"
Locusta viridissima	0·054	"	"
Vespa vulgaris	0·023	"	"
Plusia gamma	0·025	"	"
Eristalis tenax	0·037	"	"

9. During active flight the centre of gravity oscillates continually around a mean position which answers to the moments when the extremities of the wings are at the point of crossing of the figure-of-8 curve which they describe in the air.

10. In aquatic insects the centre of gravity is nearer to the lower than to the upper surface of the body.

11. During natation the movements of the oar-like posterior legs cause oscillations of the centre of gravity around a mean position, which answers to the situation of the natatory feet at the middle of their course. These oscillations of the centre of gravity induce a continual balancing of the body upon a transverse axis passing through the mean centre of gravity, and cause it, consequently, to traverse a slightly undulated path.

VIII.—*Observations on Mr. Carter's paper "On two new Sponges from the Antarctic Sea, and on a new Species of* Tethya *from Shetland; together with Observations on the Reproduction of Sponges commencing from Zygosis of the Sponge-animal.*" By J. S. Bowerbank, LL.D., F.R.S., &c.

Mr. Carter's frank and straightforward, though not very courteous style of criticism, emboldens me to adopt a like free-and-easy style in making a few observations on the subjects of his paper published in the 'Annals and Magazine of Natural History,' No. 54, June 1872. Let me ask him, then, why he designates his proposed new genus *Rossella*, without giving us the slightest idea of its generic characters, as the author himself states, p. 415, "All that I have to offer respecting this sponge is the description of two forms of spicules;" and these organs are essentially specific characters. If he had described these spicula without going to the extremity of founding a new genus and species to account for them, it would, I think, have been quite sufficient for all scientific purposes. The term *Rossella* does not seem to be a happy one, and would certainly have been perfectly incomprehensible without his reference to Ross. In the first place we have already two genera named *Rossia*, one of birds and one of mollusca; so that a third founded on the same name appears to be rather superfluous; and, as constructed by the author, it is very possible that our French friends would understand the genus, from its name, as having been founded in honour of Rossel, the eminent communist who was summarily disposed of some time since by the military tribunals of Paris.

Tethya antarctica, Carter.

The specific characters of the sponge (upon which its whole history, both actual and imaginary, is based) are given from a single specimen of a gemmule apparently somewhat distorted; but this distortion gives the author an imaginary basal anchoring character, which, however, is quite a new habit among the *Tetheæ* in their adult and natural condition. The supposed new species is illustrated in a diagrammatic series of dots and lines, which may afford effective recollections to the author, but will certainly serve any other purpose rather than that of leading future students to the identification of the species, which, I have a strong idea, is, in reality, *Tethea simillima*, from the South Sea, in the museum of the Royal College of Surgeons, and registered in the catalogue of "Contents of the Museum," part i. 1860, p. 128, B. 176, "from Tongatabue;" and he will see, in the last paragraph,

p. 148, vol. i. of 'Monograph of the British Spongiadæ,' that I have stated that that species has the same description of gemmule as the larger of the two described as belonging to *T. cranium*, but that the smaller and more simple ones which accompany the large one in that species are not present in the college specimen of *T. simillima*. A difference in the amount of the projection of the spicula beyond the margins of some parts of the object prepared for microscopical observation, as represented by Mr. Carter in his pl. xx. fig. 2, is very likely to be caused by the process of preparation for examination. In the natural condition, as represented in the gemmules of *T. cranium*, in 'Mon. Brit. Spongiadæ,' pl. xxv. fig. 344, they do not appear beyond the external membrane of the gemmule. These facts are all stated in p. 147 of vol. ii. of my work, and might have been readily verified by Mr. Carter from the specimens of *T. cranium* in the British Museum, had he taken the trouble to carefully examine them. The fact of their not appearing beyond the surface of the gemmule militates strongly against Mr. Carter's imaginary base with its anchoring spicula; and neither in the adult state of the specimens of *T. simillima*, nor in any other among the ten species with which I am familiar, are there any such anchoring spicula in their natural state.

The author, in the last paragraph of p. 410 of his paper, has evidently fallen into the error of imagining that the "ovum or, rather, young *Tethya*" is, in point of structure, the exact representative of the mature sponge, when, in truth, a very considerable difference in structural arrangement exists between them—that is, if we are to take *Tethea cranium*, the structure of which we do know, as our example of the anatomy of the fully developed sponge and the gemmules within it.

Mr. Carter appears to have been somewhat shocked by finding a jar at the British Museum labelled "'Shetland. J. S. Bowerbank, 52. 3. 12. 70–73,' to which is added, in Dr. Bowerbank's blue ink and handwriting, '*Tethya lyncurium*.'" I think Mr. Carter will find that I have not labelled the jar *Tethya* but *Tethea*, if I have labelled it myself at all. At this distance of time I only recollect that I gave some British Sponges to the British Museum, and that among them were several specimens of *Tethea cranium*; and whether I mislabelled the jar myself inadvertently, or the label was cut from the list of species sent, and so stuck on it in error, I really cannot say; the numbers on the label were certainly not put on by me. In this jar Mr. Carter found "six specimens, two of *Tethya cranium* and four of another species of *Tethya* as yet undescribed;" and the latter specimens he subsequently described as *Tethya antarctica.* Mr. Carter seems to have been exceedingly fortunate, if he be correct in his conclusions, in finding four specimens of a new species, as immediately on reading his observations on them I set myself to carefully examine the remainder of my stock of *T. cranium*, more than a hundred specimens, varying in size from a pea to an average-sized orange; and I could not find a single specimen among them that could not be satisfactorily identified as *T. cranium.* I therefore feel strongly inclined to believe that Mr. Carter has fallen into the error of making from small, unimportant differences in the same sorts of structures, two species out of one; but the dots and lines he has given in illustration of his paper are so vague and unsatisfactory, that they do not at all assist us in unravelling the mystery. The description of the gemmules of his *T. zetlandica* would apply quite as well to those of *T. cranium*; and every form of spiculum that he figures as from the former, may be readily found in the latter species.

The author, in p. 419, treating of "the small globular and compressed elliptical bodies" or gemmules of *Tethea*, writes, in the second paragraph, "In Dr. Bowerbank's 'British Sponges,' pl. 25. fig. 343, will be found a monstrous representation of one of these oviform bodies under the designation of 'gemmule,' which is only surpassed by his description (vol. ii. p. 87), where he applies the term 'sexual' to them, and conjectures that one may be the 'female or prolific gemmule;' but Dr. Bowerbank had never been able to discover any 'spermatozoa' in either! As this is a kind of physiology that I do not understand, let us go back to the term oviform &c."

If the author of the paper, in place of criticising the representation of the gemmules of *T. cranium* in vol. i. pl. 25. fig. 343, and the description of them in vol. ii. p. 87, of the 'Monograph of British Sponges,' in the flippant manner in which he has indulged, had communicated with me on the subject, I could have informed him that, instead of illustrating the anatomy of the subjects under consideration by dots and lines, the figures alluded to were drawn from the preparation still in my possession, by the aid of the microscope and the camera lucida, by one of the most talented and accurate microscopical artists that we have among us, Mr. W. Lens Aldous, and that his representation of the originals is not in the slightest degree exaggerated; on the contrary, the figure of the larger of the two is that of a gemmule rather less complicated in its structure than many of those closely adjoining it, in a slice of the sponge immersed in Canada balsam, about four lines square, and which contains twenty-one such gemmules as the two represented—fourteen of the small and more simple ones, and seven of the so-called monstrosities; and I shall at any time be happy to show the originals of the figures to Mr. Carter, and to convince him that all that is monstrous in the matter is in his own imagination. Having had ample opportunity of verifying the correctness of the figures under consideration by access to the specimens in the British Museum, and having failed in this part of his researches, it is evident that he has much more to learn of the anatomy of the sponges under consideration before he will be master of his subjects. What we want in the investigation of such matters is careful minute observations and faithful figures and records of their structure, and not abstruse hypothetical imaginations illustrated by diagrams of dots and lines. And I think I may venture to predict that no naturalist will hereafter be able, by Mr. Carter's descriptions or his illustrations, to recognize either his *Tethya antarctica* or *Tethya zetlandica*.

I must acknowledge that I have not yet been able to realize Mr. Carter's idea that a sponge is a compound creature, and that every cilium with its basal cell is a separate or distinct animal. It is a step beyond my comprehension; for if it be so in sponges, why not also in human beings? from one of whom I have seen the cilia living and in motion. The late Professor Liston, of University College, many years ago had a patient in the University Hospital with polypus in his nose; and he invited me to come up one morning, and promised to show me the human cilia in motion on a small piece of the polypus from the nose of the man. I went, and had the satisfaction of seeing them, in rather languid motion, in some of their own fluid, in a cell slightly warmed by having been put into warm water and then placed beneath the microscope. The aërating surfaces of a great variety of animals, beside sponges, are abundantly supplied with cilia and ciliated cells; are we to regard all these as compound animals?

IX.—*On a new Species of* Timalia *from Eastern India.*

By Arthur Viscount Walden, P.Z.S., F.R.S.

Timalia Jerdoni, n. sp.

Timalia pileata, Horsf. ap. Jerdon, B. of Ind. ii. p. 24, nec Horsf.

A narrow frontal band extending over the eyes, the cheeks, chin, and throat white; forehead and crown deep chestnut; remainder of upper surface dark olive-grey; quills and rectrices above brown, tinged with olive; rectrices traversed by numerous narrow bands of a darker shade of brown; upper part of breast white, changing to cinereous lower down; each feather with a black shaft; remainder of lower surface fulvous mixed with cinereous olive; under tail-coverts cinereous olive.

Longitudo

	Rostr. a nar.	Alæ.	Caudæ.	Tarsi.	
T. Jerdoni ..	0·31	2·36	2·88	0·88.	"Khasia Hills."
T. pileata ..	0·50	2·62	3·12	1·00.	"Java."

Described from specimens obtained in the Khasia Hills.

This bird has hitherto been considered identical with the Javan *T. pileata*, Horsf. A comparison I have recently been enabled to make with authentic Javan examples has convinced me of their specific distinctness. True *T. pileata* is a larger bird; in it the bill is much more powerful, its altitude being quite double that of examples from the Khasia Hills; the crown of the head is bright ferruginous, not dark chestnut; the colour of the upper plumage, wings, and rectrices is considerably paler; that of the lower is pale tawny; and the ashy colour of the black-shafted breast-plumes is less intense. My deeply lamented friend Dr. Jerdon fully concurred with me in the propriety of separating the two species.

In the 'Birds of India' (*l. c.*) this species is said to extend through the Malayan peninsula to Java; but I believe that it has never been found further south than Arakan. Neither it nor the Javan species has been shown to occur in the Malayan peninsula or in Sumatra. It seems to belong to that category of Javan forms (such as *Harpactes oreskios*, *Crypsirrhina varians*, *Bhringa remifer*, &c.) which, while absent from the intermediate regions of Sumatra and the Malay peninsula, reappear further to the north in Burma, some penetrating as far as Nipaul.

X.—*Notes on the Anatomy of the Derriah* (Cynocephalus hamadryas). By Alexander Macalister, M.B., Professor of Zoology, University of Dublin.

The Dublin Zoological Gardens received from Viscount Southwell two fine specimens of this curious animal, a male and a female, both full-grown and in excellent condition. After a residence of some months, the male sickened and died suddenly, and was dissected carefully by Professor Haughton and myself.

The most important points of the muscular anatomy of this animal are as follows:—

The trapezius was indivisible, and was inserted into the outer half of the clavicle. The sterno- and cleidomastoids were inseparable and large, being nearly an ounce in weight. The omohyoid was a single-bellied muscle, with no tendinous intersection. The trachelo-acromial was large, half the size of the sterno-cleidomastoid. The latissimus dorsi arises from the eleven spines below the fifth dorsal, and from the posterior fifth of the iliac crest, but from no ribs. The rhomboid is indivisible, but consists of the usual occipital and dorsal portions. The serratus magnus is in three parts, and extends from the second cervical transverse process to the tenth rib; the uppermost and lowest of these are strong, the middle weaker.

Serratus posticus superior is attached to the third, fourth, and fifth ribs, the inferior to the ninth, tenth, eleventh, twelfth, and thirteenth ribs. The pectoralis minor arises from the cartilages of the second to the seventh ribs, and from the abdominal aponeurosis. The deltoid is easily divisible into scapular, acromial, and clavicular parts; of these the acromial is the largest, the clavicular about half its size, and the scapular still smaller. The subclavius does not extend beyond the clavicle. The capsular muscles of the shoulder are as usual, and in the following proportions of relative development:—supraspinatus = 1, infraspinatus = 1·34, subscapularis = 1·6, teres major 0·6, teres minor = 0·17. There is a pectoralis quartus from the cartilages of the lowest ribs, inserted under the pectoralis major and below the pectoralis minor into the shoulder-capsule. The coraco-brachialis is double—a short muscle (c. brevis of Wood) weighing 0·07 of an ounce, and a longer, going to the lower third of the humerus, weighing 0·14. The two heads of the biceps humeri were inseparably united; and the entire muscle was nearly 2 ounces in weight: this muscle was 2·3 times as heavy as the brachialis anticus; and the triceps (which is divisible into long, outer, and inner parts) is exactly double the sum of these two flexors. The coracoid head of the biceps was fleshy. The dorsi epitrochlearis was thin, extending halfway down the arm, and half an ounce in weight.

There are two anconei, an outer and an inner.

Among the forearm muscles the peculiarities were:—The palmaris longus fleshy for the upper half of the forearm, and half the size of the flexor carpi radialis. The flexor sublimis has no radial origin. The flexor digitorum profundus and pollicis are inseparably connected, and there is a condyloid head separated from the rest by the median nerve. The polliceal tendon of this muscle arises from that part of the flexor mass which springs from the inner side of the olecranon.

Pronator quadratus is bilaminar, the upper layer being triangular, with the base at the ulna; the deeper layer is also a triangle with a radial base: the entire muscle occupies one fourth of the ulna and one sixth of the radius.

There is a large supinator longus, exactly equal to the pronator teres (0·4 of an ounce). The extensor minimi digiti supplies the fourth and fifth fingers. The indicator supplies the second and third digits; and there is no abductor minor pollicis (extensor primi internodii pollicis).

Palmaris brevis is very thick, and attached to the pisiform bone. The abductor pollicis brevis is divided into two—a weak external slip arising from the metacarpal bone, and an internal stronger one from the trapezium. The flexor brevis pollicis is also divided into two parts, both of which arise from the annular ligament. A distinct opponens pollicis stretches from the trapezium to the polliceal metacarpal; and there is an adductor from the middle metacarpal. The little finger has three muscles—an abductor, an opponens, and a flexor. The hand-interossei are as in man, as are the lumbricales. The abductor pollicis major is mainly inserted into the trapezium, with a few fibres into the metacarpal.

The psoas parvus is one seventh part of the psoas magnus, which latter is inseparable from the iliacus. The adductors are three, as usual; and the pectineus is very small. The gluteus maximus, agitator caudæ, and tensor vaginæ femoris are inseparable, as also are the pyriformis and gluteus medius.

The biceps femoris is ischiatic, and has only one head. The semitendinosus is one third the size of the biceps, and the semimembranosus is one fourth. The extensors of the knee are to the flexors as 11·6 : 16·09.

Plantaris is very large, and attached as usual. The flexor digitorum muscle mainly supplies the second and fifth toes, while the flexor hallucis supplies the first, third, and fourth toes. The tibialis anticus has a double tendon, and is attached to the internal cuneiform and metatarsal bone of the hallux.

The peronæus longus has a sesamoid bone in its tendon. The peronæus brevis has a thread-like offshooting tendon, representing the peronæus quinti. There is a large pyriform abductor minimi digiti. The flexor brevis digitorum has no tendon to the fifth toe; nor is there a lumbricalis for the second toe; the others are all bicipital.

From the tendon of the flexor hallucis at the ankle there arose a fleshy belly, which soon became tendinous; and this formed a head for the first lumbricalis, which was thus made into a digastric muscle.

The foot-interossei are as follows:—three plantar, an adductor hallucis, an adductor indicis, and adductor quinti digiti. The dorsals are:—abductor indicis with only one head from the second metatarsal bone, an abductor medii digiti with two heads, an adductor medii digiti, an abductor annularis.

The masseter is very large; and so is the temporal; the entire muscular mass for the closure of the jaws is over twelve ounces in weight—that is, equal to the entire quadriceps extensor cruris.

This animal is a native of Abyssinia, and, under the name of Hepi and Thoth, figured largely in the Egyptian mythology; but this part of its history has been very thoroughly elucidated by Ehrenberg in his paper "Ueber den *Cynocephalus* der Aegyptier, nebst einigen Betrachtungen über die ägyptische Mythe der Thot und Sphinx vom naturhistorische Standpunkt," in the 'Abhandlungen' of the Berlin Academy for 1833 (Physikal. Klasse, p. 337). Mr. Ogilby, however, has combated this opinion, and supposes that another species, which he names *Cynocephalus Thoth*, is the sacred animal of Hermapolis (Proc. Zool. Soc. 1843, p. 10). However, it is unquestionable that the figures of the animal in Lepsius, Rossellini, and on *Canopi* and *Scarabæi*, &c., in the Dublin University Museum, are exceedingly good representations of the Hamadryad.

The literature of the anatomy of *Cynocephali* and their allies is not extensive: the best papers on the subject are those by Pagenstecher (Drill, 'Zoologischer Garten,' 1867, p. 128), and Champneys (Anubis, 'Journal of Anat.' 1871, p. 176). In comparing the latter paper with my description, the following points may be noticed in which the Anubis and Hamadryad are dissimilar:—The trachelo-acromial is attached to the occiput in the Anubis, while it is not in the Hamadryad; the lesser pectoral was not separate in the Anubis, and the insertion of its representative was along the bicipital groove, not into the semivagina of the shoulder-joint; the rhomboids were separable in the Anubis, not in the Hamadryad; the arrangement of the serratus magnus, described by Champneys in the Anubis, was very dissimilar to what is described above; the extensor carpi ulnaris had an origin from the ulna in the Hamadryad, but not in the Anubis; the abductor pollicis major had a sesamoid cartilage in the Anubis (*l. c.* p. 184), no such thing existed in the Hamadryad; the iliacus is simple in the Hamadryad, not in the Anubis; plantaris was perfectly separate in the Hamadryad, but not so in the Anubis; Champneys's peronæus tertii in the Anubis is really, as he suggests, a quinti, as also is the so-called tertii of Church.

MISCELLANEOUS.

On some Dermal Tubercles associated with Fossil Fish-remains.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,—In the 'Annals and Magazine of Natural History' for April, pp. 260 & 261, there is an interesting communication by Messrs. Hancock and Atthey, in which they describe the discovery of certain teeth-like bodies found associated with *Cladodus mirabilis* and *Gyracanthus tuberculatus*.

They refer to a paper of mine, published in the 'Transactions of the Geological Society of Glasgow,' vol. iv. pt. 1. pp. 57–59, and state that I seem to confound *Diplodus* with those teeth-like bodies or dermal tubercles, and to consider the remains of the semicartilaginous skeleton to be shagreen,—and also state that it is to Prof. Williamson that we owe the discovery of the true nature of this peculiar substance, who clearly proves it to be the remains of what he terms the chondriform bone or semicartilaginous skeleton.

While I do not wish to call in question their deductions regarding their own discoveries, or the identifications of Prof. Williamson, I beg, however, to be allowed to express my surprise at those gentlemen supposing that I had confounded *Diplodus* with the dermal tubercles referred to.

In my paper I refer to the discovery of a slab of ironstone covered with shagreen, and two spines of *Ctenacanthus hybodoides* imbedded in that substance. Associated with these spines are a number of the teeth of *Cladodus mirabilis*, all evidently in their proper relative position. I had removed a portion of the ironstone overlying the snout, and exposed the skin thickly studded over with numerous teeth-like bodies, consisting of two, three, and four curved diverging points rising from an expanded base, and with a sharp keel on the curved side passing to the apex of each of the points.

Further on I state that I discovered on another slab of ironstone the teeth of *Diplodus gibbosus* associated with another form of those dermal teeth-like bodies; but these are smooth, enamelled, circular in section, and relatively larger, and more sharply pointed than those with the keel along the curved face. Thus having found the first form associated with the teeth of *Cladodus mirabilis* and the latter with the teeth of *Diplodus gibbosus*, and having frequently verified this discovery, the conclusion was irresistible, viz. that they each represented the dermal development of different fish; and as in the recent rays (that is, in the living forms) sexual differences are to be noted in the dermal development, I suggested the probability of the difference exhibited in the fossils being due to a similar cause. This suggestion is thrown out without the slightest desire to dogmatize, well knowing that there have been far too many forms named from being simply found associated with other parts. The evidence, however, is much in favour of the suggestion. The different forms are not only associated with, but are imbedded in, the shagreen of the fish.

From numerous microscopic sections, both of the semicartilaginous skeleton and that of the skin, there is not the slightest doubt regarding the bone of the skeleton and the shagreen of the skin. In sections of the latter I have exposed the dermal tubercles resting upon and attached to the skin.

James Thomson.

276 Eglinton Street, Glasgow.
May 27.

On the two (?) unknown Species of Argus Pheasant.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,—Permit me to make a few remarks on the feathers of the two (?) unknown species of Argus Pheasant.

The largest feather, as figured in Mr. Elliot's 'Monograph of the Phasianidæ,' part 5, is undoubtedly a relic of a bird which, when found, will probably prove to be *generically* distinct from *Argus*, so different is it in form from any feather of the known species of that genus. Of the other two feathers, which Mr. Elliot supposes to be primaries of the same bird, I have a very different opinion, believing them to be feathers of the true tail (as distinguished from the ornamental tail-coverts) of the Javan Peacock, *Pavo muticus*. I suspected this on first looking at the plate; and on examining the tail-feathers of that bird in the British Museum this opinion was confirmed, the form, colour, and markings being identical. I also found by comparison that the drawings of these feathers are of exactly the same dimensions as the real ones of *P. muticus*; whereas Mr. Elliot states them to be represented only half the natural size. This is probably a mistake; but if not, the bird to which they belonged must have been, in all probability, a very large variety or species of the genus *Pavo*.

I also wish to state that the feather which I described as belonging to an unknown bird related to *Argus* also presents certain peculiarities which seem to indicate that the bird to which it belongs is *generically* distinct; and I regret that Mr. Elliot, in quoting from the 'Annals,' omitted the note of interrogation which I placed after the word *Argus*, as I think he will agree with me that the *generic* positions of these birds can only be approximately determined from their feathers.

I remain, Gentlemen,
Yours very truly,
T. W. Wood.

London, June 15th, 1872.

Note on a Deformed Example of Cariama cristata.

By Dr. A. Günther.

There is in the British Museum a stuffed example of a Çariama which differs from *C. cristata* in so striking a manner, by the shortness of its neck and legs, that it might be easily taken for a distinct species. However, on a closer examination, I have convinced myself that it is merely a deformed example of the common Brazilian species.

1. The specimen, although fully adult, is not very old, having still reddish-brown cross bars on the outer web of the inner primaries. The state of its wing- and tail-feathers shows clearly that it has been kept in captivity.

2. The head, body, and toes are of the same dimensions as in normally developed individuals; but the tarsus, which in an old bird measures normally 7¼ inches*, is reduced in our specimen to 5¼ inches, the number of anterior transverse scutes being the same in both (26 or 27). The bone is slightly bent inwards, thus showing unmistakable signs of being malformed by rhachitic disease. Also the tibia appears to be somewhat shortened.

3. The shortness of the neck can be accounted for by the manipulation of the stuffer; but I must remark that in the skeleton of another specimen likewise kept in captivity, the eleventh and twelfth cervical vertebræ are affected by rhachitis; so that in our stuffed example the shortness of the neck may have been really caused by an abnormal curvature of the cervical portion of the vertebral column. In the skeleton mentioned the upper end of the right tibia and the first phalanx of the outer toe of the same side are much swollen in consequence of osteoporosis.

4. In the plumage not the slightest difference can be observed between this and other specimens of *C. cristata* of the same age.

It will be seen from these remarks that the Çariama, which is easily domesticated and frequently kept in captivity, is, in this state, subject to diseases of the bones, and that bodies of tame birds should not be chosen for osteological preparations.

On the Natural Affinities of the Balistidæ.

By M. C. Dareste.

In a memoir published in 1851 I showed that the Cuvierian order Plectognathi contains a certain number of very dissimilar forms united by a very imperfect character—that it must, consequently, be struck out of our classification, as M. Vogt had previously indicated, but without giving any demonstration—and that the diverse types united under this denomination must be referred to other groups of osseous fishes. Resuming these investigations, I propose to show that one of the groups of the order Plectognathi, that of the *Balistes*, must take its place among the Acanthopterygians, in the vicinity of the *Acanthuri* and other fishes belonging to the small family of the Teuthyes.

The family of the Teuthyes, as established by Cuvier, presents, in the small number of genera which he combined under this denomination, two very different types of organization. The Sidjans or *Amphacanthi*, which Cuvier placed at the head of this family, differ so much from the other genera that M. Agassiz and subsequently

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* 8¼–8½ inches (Rhenish meas.), according to Burmeister.

Dr. Günther have thought it necessary to separate them. This elimination having been made, the *Acanthuri* and the four or five allied genera which remain in the family Teuthyes have the closest affinities with the *Balistes*, as I shall now endeavour to prove.

In vertebrate animals it is the skeleton that furnishes the most correct indications as to the affinities and consequently the true characters of the natural groups. The uncertainty in which we still are with regard to the establishment of these groups among fishes will only be dissipated by the determination of their osteological types. The elements of such a work are still too completely wanting to allow of our attacking it as a whole; but we may prepare the way for it by partial investigations. Thus I now propose to demonstrate the very great analogy and the common characters of the skeletons of the *Acanthuri* and Balistidæ, especially the true *Balistes*, which are more nearly allied to the *Acanthuri* than the *Triacanthi*, *Monacanthi*, and *Aluteræ*.

In both groups the jaws are very small. The border of the upper jaw is formed solely by the intermaxillaries. The maxillaries, which are but very slightly developed, are firmly and immovably attached to the intermaxillaries. This character is the more important because it constitutes, according to Cuvier, the character of the order Plectognathi. Now the *Acanthuri* deserve to be called Plectognathi quite as much as the *Balistes*. The teeth, in both jaws, have the form of incisors.

The skull is very narrow. Its upper surface is much elongated and formed by two planes which meet at an obtuse angle above the orbit; whence it results that the true cranium descends obliquely behind the orbit to meet the vertebral column, instead of being placed in the same horizontal plane as this bony column. It also follows, from this oblique position of the cranial region, that the mastoid bone is placed very low. It nevertheless presents, in both groups, a large vertical apophysis in front of its articulation with the bones of the shoulder.

The upper occipital, or interparietal, advances between the principal frontals, and forms, at the summit of the head, a more or less elevated crest.

The ethmoid is much elongated; and consequently the anterior frontals and the palatines are at a great distance from each other, and do not become united to form bony nasal cavities.

The anterior sphenoid is produced in front of the orbit in the form of a vertical plate, which meets a vertical plate produced by the ethmoid, and forms with it a bony partition which separates the ethmoid from the palatine arch.

The vomer is very small, and destitute of teeth.

The palatines are also small, destitute of teeth, and movably articulated with the ethmoid and intermaxillary.

The different pieces of the temporal wing are not all soldered together, and leave empty spaces merely occupied by the membrane of the palate.

The opercular flap is formed only by the operculum and the sub-operculum. The interoperculum is more or less concealed within the præoperculum; at least in its anterior part, or that which is joined to the jaw, and sometimes throughout its whole extent, it presents the form of a rod. The second case is that of the *Balistes*; the former that of the *Acanthuri*, in which it acquires the form of a very narrow plate only in its posterior part.

The hyoid bone is attached to the temporal wing at but little distance from the posterior angle of the lower jaw; it is consequently very small. The lateral branches, which bear the branchiostegal rays, have fewer pieces than in other fishes. The unpaired piece, or *tail of the hyoid*, is very large, and formed of two long branches uniting at a right angle.

The bones of the shoulder appear, in the part anterior to the pectoral fins, in the form of large plates, produced by at least the partial amalgamation of the three bony pieces which, according to Cuvier's nomenclature, form the *humerus*, *radius*, and *cubitus*. The coracoid is greatly developed. The pelvis is much elongated, and the two pieces which form it are more or less soldered together.

The vertebral column is formed by a small number of vertebræ (about 20 to 22). The dorsal vertebræ bear very long vertical neurapophyses and horizontal hæmapophyses starting from the middle of the vertebra and bearing very small ribs. The caudal vertebræ have the neurapophyses and hæmapophyses vertical and much elongated.

The differences between the skeletons of the *Acanthuri* and *Balistes* are but few and of slight importance.

The *Acanthuri* have nasal and suborbital bones, which are wanting in the *Balistes*; but these bones are very variable in fishes, and can only furnish secondary characters.

The dorsal fin is single in the *Acanthuri*, whilst in the *Balistes* the spinous and soft rays are separated to form two fins.

In the *Balistes* the præoperculum has its oblique shorter than its horizontal branch; the reverse is the case in the *Acanthuri*: consequently the branchial fissures and the opercular flaps are larger in the *Acanthuri* than in the *Balistes*.

In the *Acanthuri* the dorsal hæmapophyses bear, besides the ribs, some little styles which ascend in the interior of the muscles, as in the Clupeidæ.

We see therefore that, with the exception of a few differences, the osteological type of the *Acanthuri* is the same as that of the *Balistes*. I regret that I am unable to complete this investigation by the comparison of the other organs, which must undoubtedly present resemblances similar to those of the skeletons. I must add, however, that Valenciennes has already indicated the at least apparent similarity presented by the scaling of a species of *Acanthurus* (*A. scopas*) to that of certain Balistidæ of the genus *Monacanthus*—a resemblance which had even struck the Dutch of the East Indies, since they confound the Balistidæ and the *Acanthuri* under the same denomination, that of *Leervisch*, or "leather-fishes."—*Comptes Rendus*, June 17, 1872, pp. 1527–1530.

On the Synonymy of the Genera of Euryalidæ.
By Dr. J. E. Gray, F.R.S. &c.

Having occasion to examine and determine the Red-Sea Radiata presented to the British Museum by Mr. M'Andrew, I had occasion to use MM. Dujardin and Hupé's work. The following corrections and additions to his synonymy occurred to me. They chiefly arise from the almost universal habit of French zoologists to ignore the works of any other country. In the 'Synopsis of the British Museum' for 1840 I gave the characters of the families and genera; so there is no excuse for their not being quoted.

Euryalidæ, Gray, Syn. Brit. Mus. 1840, p. 63, = *Euryalidies*, Dujardin & Hupé, 1862, p. 292.

I. Euryale, Gray, Syn. B. M. 1840, p. 62. *Euryale*, pars, Link. *Trichaster*, Agassiz, Dujardin & Hupé, 1862, p. 300.

1. *Euryale palmiferus*, Lam.

II. Astrophyton, Gray, Syn. B. M. 1840, p. 62; Müller & Troschel, Lütken, Duj. & Hupé, 1862, p. 301.
Gorgonocephalus, Leach, Zool. Misc.

1. *Astrophyton verrucosum*, Lam. &c.

III. Laspalia, Gray, Syn. B. M. 1840, p. 64, with characters.
Asterochema, Lütken, Addit. ad Hist. Ophiur. 1859, p. 255; Dujardin & Hupé, Echinod. p. 296.

1. *Laspalia oligactes* = *Asterias oligactes*, Pallas. *Asterochema oligactes*, Lütken, *l. c.*; Dujard. & Hupé, p. 297. *Ophiura cirrosa*, Say. *Trichaster leptocladia*, Mus. Paris.
Euryale simplex, Gray, Encycl. Metropol.
West Indies and Central America.

IV. Natalia, Gray, Syn. B. M. 1840, p. 64.
Asteroporpa, Lütken, Addit. ad Hist. Ophiur. 1859, p. 152.

1. *Natalia annulata.*
Asteroporpa annulata, Lütken, *l. c.* p. 159, t. 5. f. 4; Dujardin & Hupé, Echinod. p. 298, t. 2. f. 6.
Central America.

On a New Species of Paradoxornis. By the Abbé A. David.

Father Heude, Missionary at Shanghai, busies himself actively in studying and collecting the natural productions of the province in which he dwells. Among the birds in his collection which he showed me as I passed through that city there are several which do not yet figure in the ornithological catalogues of the Chinese Empire. Of these I observed one which is particularly interesting, belonging to that curious group of Insectivora *with a stout and compressed beak*; which is represented in Eastern Asia by the genera *Conostoma*, *Cholornis*, *Paradoxornis*, and *Suthora*.

The bird in question appears to me to be intermediate between the last two genera, and may, perhaps, form a new genus. I place it provisionally in the genus *Paradoxornis*, of which it presents the principal characters.

M. Heude having allowed me to take the description of his bird, which is unique in his collection, I hasten to send it to you, and regard it as my duty to dedicate to him this new species, under the name of *Paradoxornis Heudei*.

Total length	18 centims.
Length of the tail	9½ „
„ of the closed wing	57 millims.
„ of the tarse	24 „

Bill yellow; feet of a yellowish grey; claws grey.

Tail long, much graduated, with the feathers black, terminated by a broad white spot; the median feathers unicolorous yellowish grey.

Wings short and round, with the quill-feathers black, surrounded by a margin of reddish grey; lesser coverts of a cinnamon fulvous, as well as the feathers of the insertion of the wings.

Stalks of the rectrices and remiges black above, white beneath.

Head grey in the middle; two broad black streaks above the eyes, like eyebrows; neck grey; parotic region of a rosy grey; back rosy grey, with a few elongated brown spots; rump reddish yellow.

Throat white; breast of a vinous rosy colour; flanks reddish; middle of the belly whitish, as are also the subcaudals.

M. Heude killed this pretty bird in December 1871 among the reeds (*Phragmites*) which border a lake of the Kiang-Sou; these it traverses in little flocks. According to that naturalist, it possesses an agreeable voice and has the climbing (or rather clinging) habits of the allied genera.—*Comptes Rendus*, June 3, 1872, p. 1449.

Investigations on Fossil Birds. By M. A. Milne-Edwards.

At the moment when my investigations upon fossil birds approach their termination, and before the last part is given to the public, I will ask the Academy's permission to explain in a few words the results at which I have arrived during these studies, which have lasted fully twelve years.

I believe I have demonstrated, by the examination of the bones which have been found in the recent deposits in the Mascarene Islands, and which belong, for the most part, to extinct species, such as the dodo, the solitaire, the *Aphanapteryx*, *Fulica Newtoni*, large Parrots, &c., that these islands have once been part of a vast extent of land, that these lands by little and little and by a slow depression have been hidden under the waters of the ocean, only leaving visible some of their highest points, such as the islands of Mauritius, Rodriguez, and Bourbon. These islands have served as a refuge for the last representatives of the terrestrial population of these ancient epochs; but the species, confined in too limited a space and exposed to all causes of destruction, have disappeared by degrees; and man has in some measure aided in their extinction.

Madagascar evidently was not in communication with these islands; for when Europeans visited them for the first time, they did not find there any Mammalia, with the exception of some large bats; none of those remarkable Lemuridæ peculiar to the fauna of Madagascar existed in the Mascarene Islands. The study of fossil birds leads to the same result; and the three species of *Æpyornis* which M. A. Grandidier and I have been able to recognize among the fossils collected in the swamps of the south-west coast have enabled us to establish the relationship which connects these birds with the *Dinornis*, the *Palapteryx*, and *Aptornis* of New Zealand. All these species belong to the same zoological type, and make us feel that at a more or less remote epoch there may have existed some communication between these lands so far away from one another; perhaps groups of islands, now submerged, formed intermediate stations, of which unfortunately we have now no trace.

In France, from the earliest age of man, we remark sometimes in superficial deposits, sometimes in caverns, fragments of birds which furnish us with valuable indications of the climatal conditions of that epoch. Some of these species have now entirely disappeared; others, in considerable numbers, have by degrees retired towards the north—for instance, the grouse and the great hawk owl, which then were extremely common in these countries. Their presence is most significant; for even supposing, according to some naturalists, the reindeer is only found fossil in France because it had been introduced by the Finnish population, we cannot invoke the same explanation for birds which have never been domesticated. Lastly, we also find in our caves a great number of species identical with those which now inhabit temperate Europe—among others, the cock, which was supposed to be a native of India, but which, on the contrary, must have been a contemporary of the first ages of man.

It is especially the Middle Tertiary deposits which have furnished me with a rich harvest. Thus in the Department of the Allier I have recognized the presence of about 70 species belonging to very various groups, some of which no longer belong to our fauna. Parrots and Trogons inhabited the woods; swallows built in the fissures of the rocks nests in all probability like those now found in certain parts of Asia and the Indian archipelago. A secretary bird nearly allied to that of the Cape of Good Hope sought in the plains the serpents and reptiles which at that time, as now, must have furnished its nourishment. Large adjutants, cranes, flamingoes, the *Palælodi* (birds of curious forms, partaking at once of the characters of the flamingoes and ordinary Grallæ), and ibises frequented the banks of the watercourses where the larvæ of insects and mollusks abounded; pelicans floated in the midst of the lakes; and, lastly, sand-grouse and numerous gallinaceous birds assisted in giving to this ornithological population a physiognomy with which it is impossible not to be struck, and which recalls to one's mind the descriptions which Livingstone has given us of certain lakes of southern Africa.

The list I have given of the birds whose existence I have ascertained in the part of the Miocene lakes the alluvium of which has formed the deposits of St. Géraud le Puy, of Vaumas, &c., indicates the relations in which the different groups of this class of vertebrates lived. Whilst some of them are extremely common, there are others which are only found, so to speak, accidentally, and which are only represented in my collection by a single bone or only a few bones. The species most frequently met with are the water-birds: thus the ducks have left numerous remains; the cormorant is only found at certain places. Evidently at that time, as now, birds had preferences for certain places, certain rocks, &c., from which they departed but little. The little diver (*Colymboides minutus*) is less abundant than the gulls, of which two species, *Larus elegans* and *L. totanoides*, exist in profusion.

It is the same with some of the small shore-waders belonging to the genera *Totanus* and *Tringa*, whilst *Elorius* and *Himantopus* are represented by few individuals. I have found numerous bones of the ibis, and in particular of the *Palælodus ambiguus*; the four other species of the latter genus are by no means so common. Thus out of two hundred bones of these birds hardly one will turn out to be of *P. crassipes*, *P. minutus*, *P. gracilipes*, or *P. goliath*. The portions of the skeleton of the flamingo are rarely found entire at St. Géraud le Puy; whereas at Coumon and Chaptuzat, on the contrary, they are well preserved. I have only once met with the bones of the adjutant; they belonged to two young specimens, and were associated in the same excavation filled with sand. The cranes are rare; their bones are almost always broken and often injured by the teeth of rodents, as if they had lain for a long time on the bank before being carried to the bottom of the lake. The rails, the gallinaceous birds, the pigeons, the sand-grouse, the passerine birds, the raptores, and the parrots have left but few traces of their existence. These birds, from their mode of life, did not remain continually on the shores of the lakes or watercourses; their remains might be eaten or destroyed at once, and it would need a concurrence of exceptional circumstances for them to be transported by the streams into the alluvial deposits of the lakes: thus I had explored these deposits for more than ten years before I met with a single bone of a parrot, sand-grouse, secretary bird, or of several of the raptores; and some, of which I had collected the remains a long time ago, have not appeared since.

All the bones of birds collected in the Miocene beds of Weissenau, in the basin of Mayence, that I have been able to examine, present a complete resemblance to those of the Department of the Allier.

The ornithological population of the celebrated deposit of Sansan, in the Department of the Gers, presents another character; not one of its representatives is found in the lacustrine deposits of the Bourbonnais and the Auvergne: and although the greater part of the species belong to families at present existing in our fauna, not one is known to be actually living, and several of them present characters sufficient to constitute new genera.

I have discovered there a parrot of a more slender form than that of the Allier, and I have designated it by the name of *Psittacus Lartetianus*, to attach the name of my regretted master and friend to one of the most interesting species that I have ever found in this rich deposit. Some gallinaceous birds of a large size, and in this respect hardly inferior to the peacocks and true pheasants, also inhabited the shores of the little lake, where the deposits accumulated which now form the hill of Sansan; numerous passerine birds, resembling the Bengalis and Senegalis, frequented the margins of the waters; lastly, the number of species was not less than 35, and certainly new excavations will not fail to make known more.

The marine faluns of the Loire have only furnished me with a few species of birds. I have been able, however, to recognize a cormorant almost as large as that which now lives on our shores, a goose a little smaller than the bernicle, a heron, and a pheasant.

The beds of gypsum in the environs of Paris contain numerous impressions of skeletons of birds; and it is to be observed that the animals of that period deviated more from the zoological forms which exist at the present day. Thus, despite the unwillingness I feel, especially in palæontological studies, to increase the already too large number of generic groups, I have been obliged to form new genera for many among them. Thus the *Oryptornis antiquus* was nearer the hornbills than any known type; *Laurillardia* and *Palægithalus* belong to the order of passerine birds, but were quite distinct from all those now living. The *Palæortyges* are gallinaceous, of the size of a quail, but very different from those birds. *Gypsornis* is the giant of the family Rallidæ; it must almost have attained the size of a stork. *Agnopterus* approaches the flamingoes, although it displays some characters peculiar to itself.

The singularity of the forms of these Eocene birds makes us doubly regret not knowing those of the Cretaceous period. Unfortunately there exist only a very small number of freshwater deposits dating from that period; therefore it is not astonishing that we have as yet discovered only very few traces of terrestrial animals which lived during the deposition of these important strata. Perhaps new zoological forms will be discovered there filling up the immense gap which exists between the Jurassic *Archæopteryx* and the typical birds of the Tertiary epoch.—*Comptes Rendus*, April 15, 1872, pp. 1030–1034.

Migrations of the Graptolites. By H. Alleyne Nicholson, M.D., F.R.S.E., F.G.S., Professor of Natural History and Botany in University College, Toronto.

The author commenced by stating that the occurrence of the same species of marine animals in deposits in distant areas is now generally regarded as evidence that such deposits are not strictly contemporaneous, but rather that a migration from one area to another has taken place; this migration he thought would probably in many cases be accompanied by modification. Applying these principles to the Graptolites, he endeavoured to show in what directions their migrations may have taken place.

He excluded from the family Graptolitidæ the genera *Dictyonema*, *Dendrograpsus*, *Callograpsus*, and *Ptilograpsus*, and stated that the family as thus limited extended from Upper Cambrian to Upper Silurian times. The earliest known Graptolites were those of the Skiddaw Slates, which he thought would prove to belong to the Upper Cambrian series. The Skiddaw area he considered to extend into Canada, where the Quebec group belongs to it. Genera of Graptolites belonging to this area are represented in Australia; and this the author regarded as indicative of migration, but in which direction was uncertain. Having discussed the forms of Graptolites characteristic of the deposits in the Skiddaw-Quebec area, the author proceeded to indicate the mode in which the family is represented in the areas of deposition of the great Silurian series—namely, the Llandeilo areas of Wales and Scotland, the Coniston area of the North of England, the Gala area of South Scotland, the Hudson-River area of North America, and the Saxon and Bohemian areas—giving under each of these heads a list of species, with indications of their probable derivation.—*Proc. Geol. Soc.* Feb. 1872.

Notice of a new Netted Sponge (Meyerella) *from the Philippines.*

By Dr. J. E. Gray, F.R.S. &c.

The British Museum has just received a very beautiful clavate netted sponge, discovered in the Philippines by Dr. Adolf Bernhard Meyer, which I have proposed to indicate as a new genus under the name of MEYERELLA.

Sponge simple, elongate, clavate, acute at the apex, at which are placed several tufts of short cylindrical fibres. The body of the sponge is elongate-fusiform, with longitudinal ridges irregularly disposed, often inosculating together, leaving various-shaped deep concavities on the surface. These ridges and the very numerous irregularly shaped often confluent elevations in the concavities between them are furnished with various-shaped large oscules on the upper surface. The sides of the ridges and the tops of the prominences are all united by a very fine cobweb-like netted coat, formed of numerous fibres, and pierced with an immense number of very minute exceedingly close perforations. The stem cylindrical, thick, ending in a thick cylindrical tuft of elongated glassy fibres, evidently anchoring the sponge in the sand; numerous cylindrical bunches of fibre are to be seen through the substance of the sponge extending throughout the greater part of the length of the stem. Species:—*Meyerella claviformis.*

Hab. Philippines (*Dr. Meyer*, Brit. Mus.).

Additional Note on Osteocella septentrionalis.

By Dr. J. E. Gray, F.R.S. &c.

I have been informed by Dr. Günther that this species (see Ann. & Mag. Nat. Hist. ser. 4, vol. ix. p. 405) is frequently found in Buzzard Inlet, near New Westminster, Fraser River, British Columbia, which confirms my original supposition that it probably comes from the west coast of America.

THE ANNALS
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[FOURTH SERIES.]

No. 56. AUGUST 1872.

XI.—Antipathes arctica, *a new Species of Black Coral* (Antipathidæ) *from the Polar Seas.* By Dr. C. LÜTKEN[*].

A LITTLE before the commencement of the illness which at the end of last year carried off M. C. S. M. Olrik, Councillor of Justice and Director of Greenland trade, and formerly Inspector in North Greenland, thus inflicting upon science a serious loss by depriving us of a man who had striven with much zeal and great perseverance to elucidate the natural history of Greenland, especially in collecting its zoological and palæontological objects for our museums, that gentleman brought to me at the museum a black coral which, as he knew with certainty, was found in the stomach of a shark (*i. e.* a sea-hound, *Scymnus microcephalus*) in Rodebay[†], about two miles north of Jakobshavn, in North Greenland, by M. K. Fleischer. This discovery is of great interest in many respects. It increases our knowledge of the Greenland fauna with a genus, and, indeed, with a family, which had not previously been included in it; nay, what is more, this family was previously known only from warm or very warm seas: north of the Mediterranean [‡]

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[*] Translated by W. S. Dallas, F.L.S., from the 'Oversigt over det Kongl. Danske Vidensk. Selsk. Forhandl.' 1871, pp. 18–26.

[†] Rink calls it "Rödebay." I do not know which of these denominations is the right one.

[‡] The text was already printed when Professor Wyville Thomson had the kindness to inform me that Antipatharia had been found in the British expeditions for the exploration of the great depths by means of the dredge, and consequently in a part of the Atlantic situated between the polar seas and the warm seas which, until recently, formed the northern limit of the known Antipatharia.

From the Mediterranean we know with certainty apparently five species—namely, *Antipathes larix*, Esper, *subpinnata*, Ellis, and *dichotoma*, Pall., *Leiopathes glaberrima* (Esper) and *Gerardia Lamarckii* (J. Haime); whilst I regard it as very doubtful whether *Antipathes scoparia*, Lamk., and *Cirripathes spiralis* (Pall.) also occur in the Mediterranean, as is and South Carolina no Antipathid has hitherto been known; and that a representative of this group is now suddenly discovered in the extreme north certainly makes a very considerable alteration in the notions which we have hitherto entertained as to its geographical distribution, and leads us to conjecture that it may extend to all the deeper valleys of the ocean[*]. That the Greenland species belongs to deep water is warranted by the sea-hound's well-known habit of seeking its food at great depths (200–250 fathoms); that it should have gone to fetch this little "sea-shrub" very far from the place where it was itself caught we may regard as not very probable. It is true that the sea-hound, like the sharks in general, is a fish which wanders pretty widely; and we have instances of its straying far beyond its proper range—to Scotland and the north of France, for example. But, nevertheless, in the present case it would be improbable that it should have sought

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stated by Milne-Edwards (Hist. Nat. des Corall. tome i. pp. 314–319). The last mentioned is a native of the East Indies; and other species of its genus are known from the West Indies, Madeira, and Australia. *Antipathes scoparia* I believe I have recognized with certainty in a form from the Red Sea represented in our museum. Of the species which are stated only by older writers (*e. g.* Lamouroux) to be from the Mediterranean we may probably take no notice. From Madeira also various species are known (*Cirripathes setacea* and *gracilis*, Gray, *Antipathes furcata*, Gray, and *subpinnata*, Ellis?)—and from South Carolina *Antipathes Boscii*, Lamk., and *A. alopecuroides*, Ellis. In the tract between Florida and Cuba Pourtales found five species (*A. filix*, *humilis*, *tetrasticha*, and two undescribed species). Besides these we know a whole series of species from the West Indies:—*Cirripathes Desbonni*, Duch. & Mich.; *Antipathes pedata* and *atlantica*, Gray; *A. americana* and *dissecta*, Duch. & Mich. (both from St. Thomas); *A. eupteridea*, Lamk. (Martinique); *Arachnopathes paniculata*, Duch. & Mich. (Guadeloupe); and *Leiopathes compressa*, Esp. (Jamaica). Many of these, however, are but imperfectly known. *A. reticulata*, Esp., and *A. larix*, Esp., are also represented as West-Indian; but this can hardly be correct, but due to mistakes either in the determination or in the statement of localities. *A. reticulata* is an East-Indian species (Manilla), and *A. larix* is a native of the Mediterranean. From Cape Palmas we have *A. spinescens*, Gray. From the southern part of the Atlantic we know no Antipatharia.

[*] Marsigli took *A. dichotoma* at a depth of 140 fathoms. Pourtales captured his species at 116–120, 270, and 195–324 fathoms. Heller took *Gerardia Lamarckii* at 50–60 fathoms, in company with red corals. That the Mediterranean black corals (*palmas neras*) usually occur in this association, and at considerable depths, is known from Lacaze-Duthiers's admirable investigations upon the Antipatharia. That those in warmer seas also occur at much smaller depths, however, appears from the fact that Dana obtained *A. arborea* in 10 fathoms and *A. anguinea* in 10 feet of water at the Fiji Islands (Explor. Exped. Zoophytes, pp. 577 & 585). At the Pearl Islands, in the Gulf of Panama, Bradley obtained *A. panamensis*, by means of pearl-divers, from 6–8 fathoms (Verrill, "Notes on Radiata, No. 6," p. 500, Transact. Conn. Acad. i.).

its prey beyond the Polar Sea; and were we even to stretch this possibility to its utmost limits, this Antipatharian would still remain a *northern* form, and the diffusion of the family as far as the northern seas would remain indubitable.

The Black Corals, or Antipathidæ, are still among the less-known animal-forms; it is only a few years since their structure was so far elucidated[*] that they could be arranged in their right place in the system as a type analogous to the Horny Corals (Gorgoniidæ) in the sex- or multitentaculate order of Coralliaria. On account of the great softness and perishableness of the outer layer ("flesh"), which, again, is chiefly caused by the apparently total want of hard parts ("sclerites"), it is seldom that we find in collections specimens which show any traces of this the essential living part of these animals—the horny, most frequently black and spinous "axis" being in general all that remains, and the only thing that we have to depend upon in the description, specific distinction, and grouping of these forms. Most of them, moreover, are known only by imperfect descriptions or defective figures (those of Professor Lacaze-Duthiers's excellent revision[†] of the whole family, founded on the materials in the Paris Museum, have, unfortunately, never appeared); and of not a few we do not know whence they come. That under these circumstances the determination of species presents nearly insuperable difficulties will be evident; but, on the other hand, I must admit, after the experience that I have been able to obtain by the examination of the comparatively considerable collection in the Museum (seventeen species), that in general it is not difficult to trace the limits between one species and another. The modes of ramification especially present many characteristic and easily grasped differences, although it may be less easy to express these in words.

That the present specimen, after lying, whether for a short or a long time, in the stomach of a shark, is without any trace of the softer and more perishable parts, is a matter of course; but in other respects it is well preserved. That it represents a new species is also very probable, as the locality of its occurrence is so exceedingly distant from that of any previously known Antipathid. But upon this circumstance we must not for the present lay very great stress, as it is certain that

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[*] First elucidated (if we leave out of consideration what Marsigli (1725), Ellis (1786), and Gray (1832) had previously published with regard to it) by Dana (Explor. Exped. Zoophytes, x. tab. 56. figs. 1 & 2), and afterwards more completely by Lacaze-Duthiers (Ann. Sci. Nat. 5e sér., Zool. & Pal., tomes ii. & iv. 1864–65).

[†] *Loc. cit.* tome ii. p. 173, and several other places.

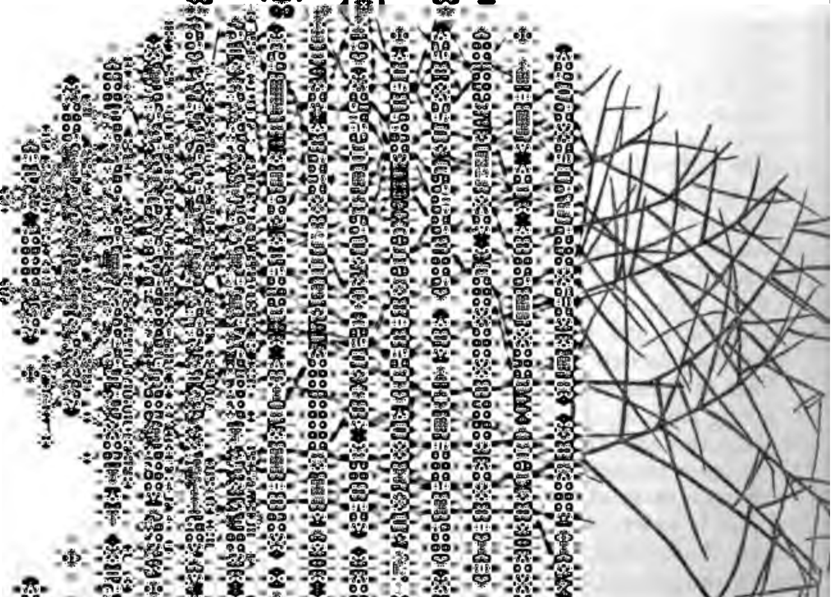
Black Coral

which may extend

If it is actually

Fig. 2.

of a branch, enlarged.



diminished.

the case that a whole series of northern Echinoderms (*Rhizocrinus lofotensis*, *Pteraster militaris*, *Echinus Flemingii*, *Brissopsis lyrifera*, *Echinocardium ovatum*, *Echinocucumis typica*, *Cucumaria frondosa*, and *Molpadia borealis*[*]) live together in the deep water around and among the Antilles, there is, of course, nothing against the possibility that an Antipathid also might be diffused from the icy sea to south of the tropic of Cancer; and our thoughts turn quite naturally at once to the species recently recorded by Pourtales[†] from the Straits of Florida. Nevertheless I have been unable to refer the present form to any species known to me either in nature or from descriptions or figures; and although this, considering what has been said above as to the defective state of this department of our science, is not much to say, I hope that I shall not fall into any mistake in describing it as new. For its recognition the annexed photoxylographic figure (fig. 3) will, I hope, furnish sufficient means, although I will not omit to add a short description of it; but first I will endeavour to determine its approximate place in the systematic arrangement of the Antipathidæ.

According to Milne-Edwards's proposed classification of this family, our Greenland species is undoubtedly a true *Antipathes*; it is branched and has a rough surface, and its branches show no very great tendency to coalesce (as in *Arachnopathes* and *Rhipidipathes*), although, apparently accidentally, a slight amalgamation occurs at isolated points. I shall leave it for the present undecided how far it may be possible to distinguish the genera of Antipathidæ in the mode attempted by the above-mentioned distinguished zoologist: opinions are divided upon this subject[‡]; and the analogous genera to them in the parallel group of the Alcyonaria have not stood the test of the more thoroughgoing analysis of recent times; but under any circumstances the above-mentioned amalgamation of the branches at particular points will not justify us in giving our species a place outside the genus *Antipathes*. In this genus *A. arctica* will take its place among the species whose branches and stems are not very different in thickness ("polypier se subdivisant en branches de divers ordres, qui ne diffèrent que peu les uns des autres par leur diamètre, lequel décroît graduellement"); but it belongs neither to the species whose branches lie in all possible different planes, and thus form tufted masses ("panicules, touffes") of different forms, nor to those in which they all lie in the same plane, and form as it were a quadrifid or bipinnate leaf (*A. myriophylla*, *pinnatifida*). It stands about in the middle between these two chief types of the genus, and seems at the same time to point from this towards *Arachnopathes*.

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The stem is nearly straight, widening below into a flat expansion, by which it has been attached at the bottom of the sea; its height, in a direct line, is 113 millims., and its diameter about 1¼ millim.; superiorly it decreases very slowly in thickness; only its lowest portion is smooth, the remainder being covered with somewhat irregular fine furrows; on the raised lines separating these furrows are seated the short acute spines in tolerably close series (fig. 1). The shining black colour of the stem gradually acquires a brownish tint in its upper part; its lower part (about 30 millims.) is destitute of branches; but from the upper part of the stem there issue on each side, right and left, 10–13 *main branches*. Except in the uppermost part of the coral, where some irregularity occurs, the points of origin of these main branches are placed pretty regularly, alternately to the right and left. The distance between two branches situated one above the other on the same side is at the utmost 9 millims. On the whole the middle branches are the longest and strongest; the angle which they form with the stem is not much less than a right angle, and their direction is therefore nearly horizontal. All the branches placed one above the other on the same side lie, at least approximately, in the same vertical plane; and the angle which those from the two sides form with each other at their origin is only a little more than a right angle; and as they curve in an elongated arc at first forward and then backward, their points come to lie in the same (vertical) plane as their points of origin. If we leave the curvature out of consideration, all the coral's horizontal main branches will therefore lie approximately in the same plane. These main branches are not much less in diameter than the upper part of the stem; and they maintain this character nearly throughout their whole length;

their surface is spinous (fig. 2), like that of the stem; but raised and depressed lines are seen only where they are thickest, which is not always nearest to the base; the length of the largest main branch is about equal to that of the branch-bearing part of the stem. The *secondary branches*, which are only a little thinner than the main branches, and have an average length of about 35 millims. (of course there are many much shorter, and some much longer), spring from the main branches at right angles and at an average distance of 8–12 millims. apart; some are directed upwards, and others downwards, whilst others, again, project more or less obliquely forwards, but none backward. The hinder surface of the coral is, in fact, completely without branches; all the secondary and tertiary branches are turned more or less towards the same side, namely the anterior side. At certain points where secondary branches have met or crossed each other, an amalgamation has taken place; but in this there is nothing particularly regular, and it therefore appears to me probable that we may find specimens in which no such coalescence has taken place at any point. All the secondary branches are spinous, like the stem and main branches; and the finer they are, the lighter brown is also their colour.

As only a single specimen is extant, I have in this short description been unable to separate what is only individual and what may be regarded as characterizing the species. I shall now, however, endeavour to bring together in the form of a diagnosis those peculiarities which, until more material may be before us, may serve to distinguish it from the other known Antipathidæ.

Antipathes arctica, Lütken.

Sclerobasis (axis) cornea, nigra vel nigro-fusca, spinosa, arborem humilem, latiorem quam altiorem constituit; stipes erectus, teres, gracilis, niger, basi lævis, ceterum spinulis brevissimis, longitudinaliter seriatis, cum sulculis minutis alternantibus, asper; rami (primarii) patentissimi, horizontales fere, bifariam dispositi, utrinque 10 vel ultra, gracillimi, asperi, colore dilutiore, ramulos (secundarios, tertiarios) similes emittunt, angulos rectos cum ramis (primariis, secundariis) formantes, sursum, deorsum vel antrorsum inclinatos; rariter coalescunt. Superficies dorsalis vel posterior arboris totius ramulis omnino caret. Altitudo c. 5 pollices, latitudo 6½ poll.

In ventre *Scymni microcephalo* prope oras Grönlandiæ septentrionales inventa.

XII.—*Additions to the Australian* Curculionidæ. Part III.

By Francis P. Pascoe, F.L.S. &c.

[Plate I.]

AMYCTERINÆ.
Mythites asperatus.
—— pithecius.
—— degener.
Ædriodes, n. g.
—— fastigiatus.
—— mendosus.
—— inuus.
Acherres, n. g.
—— mamillatus.
Ennothus, n. g.
—— fallax.
Oditesus, n. g.
—— indutus.
—— lycosarius.
—— incœnis.
—— perditus.
—— sulcirostris.
—— buceros.
Sosytelus, n. g.
—— lobatus.

CYLINDRORHININÆ.
Centyres ovis.
Enchymus humeralis.

ERIRHININÆ.
Aoplocnemis lineata.
Œnochroma, n. g.
Œnochroma rubeta.
Misophrice, n. g.
—— hispida.
Orpha persimilis.
Phrenozemia, n. g.
—— lyproides.

BELINÆ.
Belus centralis.

CYLINÆ.
Myrmacicelus exsertus.

CRYPTORHYNCHINÆ.
Mœchius, n. g.
—— anaglyptus.
Agriochæta, n. g.
—— crinita.
Tragopus plagiatus.
Imaliodes nodulosus.
Drassicus, n. g.
—— nigricornis.
—— illotus.
Agenopus, n. g.
—— agricola.
Nechyrus incomptus.

ZYGOPINÆ.
Idotasia æqualis.
—— evanida.

Mythites asperatus.

M. subelongatus, ovatus, niger, capite supra oculos corrugato; rostro latitudine haud longiore, in medio sulco profundo apicem versus valde ampliato, impresso, emarginatura triangulari indistincta; prothorace vix transverso, ante medium paulo rotundato, postice angustiore, crebre grosse granulato, in medio leviter sulcato; elytris basi prothorace paulo latioribus, ovatis, angulo humerali modice productis, inæqualiter grosse tuberculato-granulatis cavitatibus foveiformibus impressis; corpore infra lævigato; pedibus setosulis. Long. 7 lin.

Hab. Sydney.

This species differs, *inter alia*, from *M. basalis* and *M. sulcicollis* in the absence of the larger conical tubercles, those on the elytra in ill-defined groups of 3–5, the intervals here and there with foveiform impressions.

Mythites pithecius.

M. ovatus, niger, capite rostroque mamillato-punctatus, hoc basi quadrilobato, lobis duobus intermediis prominulis, infra medium

rugoso-impresso, apice emarginatura triangulari parva, marginibus elevata; scapo flexuoso, apicem versus valde incrassato; prothorace sat fortiter rotundato, apice valde prominulo, in medio sulcato, granulis mamillatis nitidis majusculis, nonnullis confertis, munito; elytris prothorace vix latioribus, postice gradatim amplioribus, angulo humerali recto, transversim grosse undulato-granulatis, granulis unisetigeris, singulo elytro postice tuberculo oblongo obtuso obsito; corpore infra sparse punctato-setoso; pedibus setis numerosis adspersis. Long. 5 lin.

Hab. New South Wales (Monaro).

Allied to *M. basalis*, but smaller, with a different rostrum and the elytra more regularly and less strongly sculptured.

Mythites degener.

M. sat anguste ovatus, niger, capite inter oculos carina depressa notato, supra oculos cristato; rostro tenuiore, basi profunde transversim sulcato, antice fortiter sulcato, sulco angustiore, versus apicem minus ampliato; prothorace latitudine vix longiore, modice rotundato, irregulariter rude granulato, in medio profunde sulcato; elytris basi prothorace haud latioribus, lateribus ♂ subparallelis, ♀ subovatis, apicibus parum emarginatis, subseriatim foveolatis, interstitiis alternis antice paulo, postice magis elevatis et in tubercula plus minusve nodiformia dissolutis, humeris antrorsum fortiter productis; abdomine maris in medio longitudinaliter piloso; pedibus setulis albidis adpressis adspersis. Long. 4½–5 lin.

Hab. South Australia (Port Lincoln).

Much less strongly sculptured than *M. sulcicollis*, with only a single depressed carina in front.

ÆDRIODES.

Caput antice convexum, circa oculos elevatum; *rostrum* breve, capite angustius, antice bilobum, inter lobos sulcatum, emarginatura triangulari terminatum; *scrobes* breves, arcuatæ. *Antennæ* breviusculæ, *clava* distincta. *Oculi* parvi, subovati, a prothorace distantes. *Prothorax* rotundatus, convexus, apice productus, basi truncatus, lobis ocularibus distinctis, plus minusve prominulis. *Elytra* oblonga vel ovata, humeris antrorsum productis, postice declivia. *Pedes* subvalidi; *tibiæ* rectæ; *tarsi* modice elongati.

The small roundish eyes away from the prothorax, notwithstanding its ocular lobes, offer a good diagnosis of this genus. Besides the species described below, which are all very distinct, though the sculpture seems liable to some variation, *Euomus nodipennis*, Boh., is also to be referred to it. *Phalidura scorpio*, Bois., seems to me to be the species on which Schönherr founded his genus *Euomus*, naming it, but without any description, *E. Fahræi.*

Ædriodes fastigiatus. Pl. I. fig. 8.

Æ. subparallelus, niger, opacus; rostro sparse setoso; prothorace longitudine paulo latiore, utrinque fortiter rotundato, valde convexo, apice trisulcato, sulco intermedio longiore ad basin currente, dorso confertim mamillato-granulato, granulis depressis, unisetigeris; elytris prothorace paulo latioribus, subparallelis, supra deplanatis, subseriatim punctatis, interstitiis tertio quintoque carinatis, carina interiore abbreviata, profunde incisa, exteriore in tubercula quatuor dissoluto, uno humerali cristato-producto, duobus sequentibus dentiformibus, ultimo majusculo, lobiformi, ad marginem declivitatis sito, marginibus postice serrato-setigeris, apicibus acutis; corpore infra sparse fortiter punctato; pedibus punctatis et atro-setosis. Long. 5 lin.

Hab. King George's Sound.

The subparallel elytra and strong humeral crest afford a good differentiation for this species.

Ædriodes mendosus.

Æ. oblongo-ovalis, niger squamulis silaceis vel subcupreis valde adspersus; rostro breviore, minus fortiter punctato; prothorace modice rotundato, antice profunde trifoveato, fovea intermedia majore, confertim mamillato-tuberculato, tuberculis conicis elevatis, setis nigris coronatis; elytris prothorace vix latioribus, ovalibus, convexis, lateribus paulo rotundatis, supra subseriatim granulato-punctatis, singulatim tuberculis circa decem, majusculis, conicis, in seriebus duabus ordinatis, lateribus, etiam fortiter sulcato-punctatis, tuberculis parvis inæqualibus obsitis, illis pluri-, his unisetigeris, angulo humerali carinatis, apice parum producto, anguste sed profunde emarginato; corpore infra coriaceo, impunctato, setulis minutis adsperso; pedibus silaceo-squamosis, setis numerosis nigris interjectis. Long. 4½ lin.

Hab. King George's Sound.

The granules on the elytra are seated between the punctures; or, rather, the spaces between the punctures are granuliform; in this respect it differs, *inter alia*, from the next species.

Ædriodes inuus.

Æ. anguste ovatus, niger, squamulis minutis subcupreis adspersus; capite fere impunctato; rostro prothoraceque ut in *Æ. mendoso*; elytris basi prothoracis vix latioribus, supra subseriatim impresso-punctatis, haud granulatis, interstitiis tertio quintoque antice granulato-carinatis, postice tuberculis conicis, illo duobus, hoc tribus, instructis, lateribus fortiter sulcato-punctatis, interstitiis valde elevatis, angulo humerali carinatis, apice obtuse rotundato, vix emarginato; corpore infra coriaceo, obsolete punctato; pedibus ut in præcedente. Long. 4–5 lin.

Hab. Western Australia.

ACHERRES.

Caput antice convexum, rotundatum; *rostrum* validum, breve, versus apicem gradatim crassius, basi transversim sulcatum, bialatum, ala utrinque supra oculum currente; *scrobes* breves, laterales, parum arcuatæ. *Oculi* parvi, rotundati, a prothorace distantes. *Antennæ* breviusculæ, *clava* distincta. *Prothorax* breviter ovatus, apice truncatus, lobis ocularibus nullis. *Elytra* ovalia, basi prothorace haud latiora, utrinque antrorsum paulo producta, postice declivia, plica epipleurali ad apicem instructa. *Pedes* subvalidi, setosi; *femora* paulo incrassata; *tibiæ* rectæ; *tarsi* robusti; articulis tribus basalibus triangularibus, ultimo haud bilobo, postice paulo longiores. *Abdomen* segmentis marginibus prominulis, 3–4 conjunctim secundo longioribus.

The essential characters of this genus lie in the absence of the ocular lobes and in the form of the rostrum. The claw-joint is received in a cavity of the preceding one, and the three basal are all prolonged beneath into a sort of spine. This structure is common to most genera of the subfamily, and more or less to the Brachycerinæ, Byrsopinæ, &c.

Acherres mamillatus. Pl. I. fig. 5.

A. niger, opacus, plerumque esquamosus, aliquando sparse silaceo-maculatus; capite antice impunctato; rostro inter alas late sulcato, sulco lateribusque punctis grossis sparse impresso; prothorace parum longiore quam latiore, sat confertim mamillato, mamillis validis, singulis profunde foveatim impressis, setam gerentibus, interspatiis (aliquando) ferrugineo-squamosis; elytris in medio prothorace fere duplo latioribus, grosse seriatim punctatis, dorso mamillis nonnullis depressis, aliis externe tuberculiformibus, quarum duabus posticis majoribus, instructis, his punctis plurimis, illis punctis 1–3 impressis, punctis generaliter setigeris; corpore infra sparse punctato-setoso; pedibus, articulo ultimo tarsorum incluso, valde setosis. Long. 4 lin.

Hab. Western Australia.

ENNOTHUS.

Acherre differt *rostro* bicornuto, *plica* epipleurali elytrorum nulla, et *tarsis* articulo ultimo bilobo.

In *Acherres* the base of the rostrum is prolonged into two wing-shaped bodies extending above and overlapping the eyes on each side; in this genus it is nearly the same as in *Oditesus*; but in the absence of ocular lobes and in habit it agrees with the former genus.

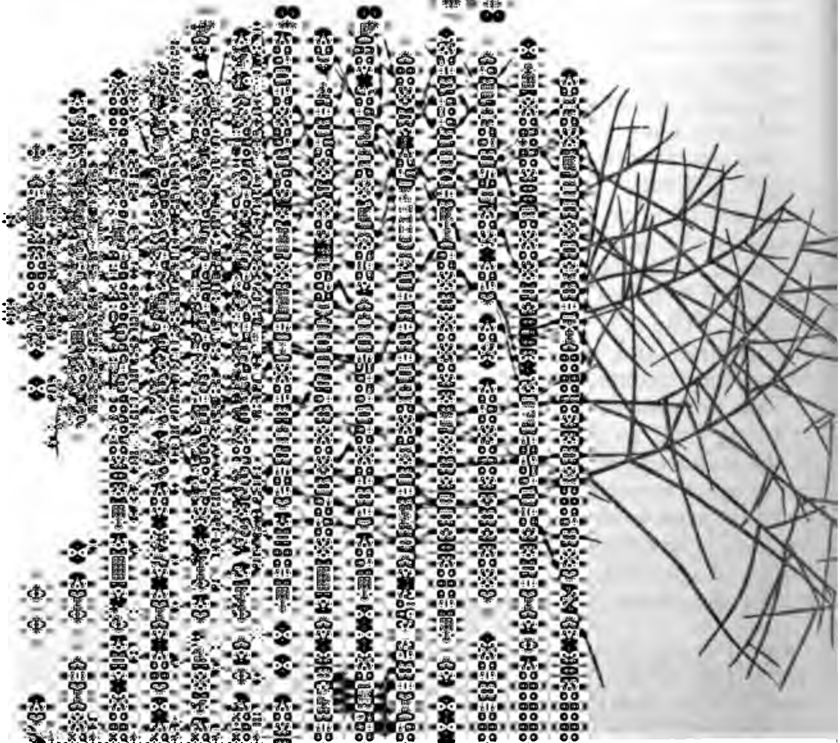
Ennothus fallax.

E. niger, opacus, supra squamulis piliformibus minutis rarissimis indutus, subtus squamulis longioribus minus dispersis; capite

[illegible] which may extend [illegible]. If it is actually

Fig. 2.

[illegible] p of a branch, enlarged.



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In ventre *Scymni microcephalo* prope oras Grönlandiæ septentrionales inventa.

quadratis approximatis, basi lateribusque plaga magna nivea e squamulis condensatis ornatis; pedibus squamositate alba indutis, setis minoribus interjectis. Long. 1¼ lin.

Hab. South Australia.

Orpha persimilis.

O. subdepressa, picea, nitida, rarissime niveo-pilosula; (♀) rostro prothorace duplo longiore, subtiliter lineatim punctulato; scapo articuloque basali funiculi flavo-testaceis, cæteris clavaque piceis, sparse niveo-pilosis; prothorace subconico, utrinque rotundato, sat confertim tenuiter punctulato, pone apicem constricto; scutello semiorbiculari; elytris latitudine duplo longioribus, substriatim punctatis, interstitiis planatis et impunctatis; corpore infra pedibusque fuscis, sparse albo-pilosis; unguiculis flavidis. Long. 1½–2 lin.

Hab. Sydney.

Very like *O. flavicornis*; but, besides the absence of pubescence, that species has a much coarser punctation, and the elytra strongly sulcate, with the intervals finely punctured; the coloration of the antennæ is also different. In this species the scrobes are not connivent beneath, the septum between them passing distinctly to the throat; in *O. flavicornis* its form is wedge-shaped, and it terminates at the middle of the scrobes, which at that point become connivent.

PHRENOZEMIA.

Caput conicum, rostro continuatum. *Oculi* depressi, rotundati, a prothorace distantes. *Rostrum* cylindricum, modice elongatum, sat validum, parum arcuatum; *scrobes* præmedianæ, infra rostrum et ad oculos currentes. *Scapus* oculum vix attingens; *funiculus* 7-articulatus, articulo primo crassiore, secundo longitudine æquali, cæteris brevioribus, duobus ultimis turbinatis; *clava* distincta. *Prothorax* subcylindricus, margine antico truncatus, basi vix bisinuatus. *Scutellum* punctiforme. *Elytra* oblonga, prothorace multo latiora, humeris rotundata. *Pedes* mediocres; *femora* in medio incrassata, mutica; *tibiæ* flexuosæ; *tarsi* articulis tribus basalibus brevibus, tertio vix dilatato, ultimo elongato; *unguiculi* simplices. *Abdomen* segmentis tertio quartoque conjunctim secundo brevioribus; sutura prima arcuata.

In Lacordaire's tabulation of his "groupe Eugnomides," one of the five subdivisions of the Erirhininæ, this genus would be placed next to *Ophthalmoborus*. These tabulations are generally of an artificial character; yet it would be often difficult to suggest a better place for the genera than they offer. Such is the case with *Phrenozemia*, as the rostrum and depressed eyes do not allow of an approximation to any genus of the group. In the species described below the scales have

their surface is spinous (fig. 2), like that of the stem; but raised and depressed lines are seen only where they are thickest, which is not always nearest to the base; the length of the largest main branch is about equal to that of the branch-bearing part of the stem. The *secondary branches*, which are only a little thinner than the main branches, and have an average length of about 35 millims. (of course there are many much shorter, and some much longer), spring from the main branches at right angles and at an average distance of 8–12 millims. apart; some are directed upwards, and others downwards, whilst others, again, project more or less obliquely forwards, but none backward. The hinder surface of the coral is, in fact, completely without branches; all the secondary and tertiary branches are turned more or less towards the same side, namely the anterior side. At certain points where secondary branches have met or crossed each other, an amalgamation has taken place; but in this there is nothing particularly regular, and it therefore appears to me probable that we may find specimens in which no such coalescence has taken place at any point. All the secondary branches are spinous, like the stem and main branches; and the finer they are, the lighter brown is also their colour.

As only a single specimen is extant, I have in this short description been unable to separate what is only individual and what may be regarded as characterizing the species. I shall now, however, endeavour to bring together in the form of a diagnosis those peculiarities which, until more material may be before us, may serve to distinguish it from the other known Antipathidæ.

Antipathes arctica, Lütken.

Sclerobasis (axis) cornea, nigra vel nigro-fusca, spinosa, arborem humilem, latiorem quam altiorem constituit; stipes erectus, teres, gracilis, niger, basi lævis, ceterum spinulis brevissimis, longitudinaliter seriatis, cum sulculis minutis alternantibus, asper; rami (primarii) patentissimi, horizontales fere, bifariam dispositi, utrinque 10 vel ultra, gracillimi, asperi, colore dilutiore, ramulos (secundarios, tertiarios) similes emittunt, angulos rectos cum ramis (primariis, secundariis) formantes, sursum, deorsum vel antrorsum inclinatos; rariter coalescunt. Superficies dorsalis vel posterior arboris totius ramulis omnino caret. Altitudo c. 5 pollices, latitudo 6½ poll.

In ventre *Scymni microcephalo* prope oras Grönlandiæ septentrionales inventa.

figure of the latter in the 'Voyage de la Coquille,' Entom. pl. 6. fig. 7.

MŒCHIUS.

Caput hemisphæricum; *rostrum* tenue, arcuatum; *scrobes* antemedianæ, infra rostrum currentes. *Scapus* oculum attingens; *funiculus* 7-articulatus, articulo primo crassiore; *clava* adnata, ovata. *Oculi* rotundati, laterales, grosse granulati. *Prothorax* breviter subconicus, apice productus, lobis ocularibus distinctis. *Elytra* cordata, prothorace multo latiora. *Femora* valida, longiuscula, infra dentata; *tibiæ* breves, flexuosæ, sulcatæ; *tarsi* breviusculi. *Rima* pectoralis usque ad marginem posteriorem metasterni extensa. *Abdomen* segmentis duobus basalibus ampliatis; sutura prima distincta.

The only exponent of this genus has much the habit of *Melanterius porcatus*, Er.; but, the metasternum entering into the formation of the pectoral canal, the genus must be referred to the neighbourhood of *Mecistocerus* and *Ædemonus**, although differing from both in the characters of the antennæ, legs, sculpture, and in the pectoral canal passing behind the intermediate coxæ.

Mœchius anaglyptus.

M. breviter ovatus, convexus, nitide niger; capite crebre punctato; rostro prothoraci longitudine æquali, in medio fere obsolete carinato; antennis fulvo-testaceis; funiculo articulo secundo primo longiore; reliquis brevibus, gradatim magis transversis; prothorace antice paulo tubulato, utrinque rotundato, basi bisinuato, confertim punctato, punctis nonnullis confluentibus, totis in fundo squamulam minutam albam gerentibus; scutello angusto; elytris profunde late sulcatis, sulcis fortiter foveatis, interstitiis carinatis et utrinque uniseriatim punctulatis; abdomine segmentis duobus basalibus, femoribusque grosse punctatis, punctis unisquamigeris; tibiis basi sat valde arcuatis, sulcis uniseriatim albo-setosis; tarsis extus unguiculisque rufescentibus. Long. 2⅔ lin.

Hab. Wide Bay.

AGRIOCHÆTA.

Caput parum exsertum; *rostrum* validum, æquilatum, arcuatum; *scrobes* præmedianæ, obliquæ, infra rostrum exeuntes. *Scapus* oculum haud attingens; *funiculus* 7-articulatus, articulis tribus ultimis turbinatis; *clava* conica, distincta. *Oculi* sat magni, ovati, laterales. *Prothorax* transversus, basi rotundatus, lobis ocularibus nullis. *Elytra* ampla, prothorace multo latiora. *Pedes*

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* *Ædemonus*, Schönherr, not Lacordaire; the former author expressly states *Æ. eminentepunctatus* to be the type; Lacordaire describes the genus from *Æ. Erichsoni*: the two species are not congeneric, as Lacordaire himself states; the latter, therefore, should receive a new generic name.

mediocres; *femora* crassa, mutica; *tibiæ* rectæ, apice haud uncinatæ vel mucronatæ; *tarsi* articulis primo secundoque late triangularibus, tertio fortiter bilobo; *unguiculi* liberi. *Coxæ* anticæ haud contiguæ. *Pectus* longitudinaliter canaliculatum. *Mesosternum* angustum, depressum. *Metasternum* breve. *Abdomen* segmentis duobus basalibus amplis.

The character of the pectoral canal places this genus in Lacordaire's arrangement with his "*sous-tribu* Ithyporides," but not in the "*groupe*" of that name, nor in any of the remaining six into which he has divided his "*sous-tribu*." It is, however, questionable whether he would have not placed it in the Erirhininæ, like *Aubeonymus*, which also has a pectoral canal. In a family so difficult to classify as the Curculionidæ, I think it would be better to adhere more strictly to characters, even if it should in some cases lead us away from an apparently more natural arrangement. The species described below is, from its hairiness and coloration, not unlike *Ocladius variabilis*, Ol., after which genus I am content for the present to place it.

Agriochæta crinita. Pl. I. fig. 2.

A. late ovata, modice convexa, nigra, supra pilis longis nigris, nonnullis albis, vestita; rostro capite duplo longiore, sat sparse piloso; antennis ferrugineis; scapo ab oculo sat longe terminato; funiculo articulis duobus basalibus æqualibus, tertio præcedente fere duplo breviore; prothorace antice utrinque rotundato, postice parallelo, lateribus dense niveo-pilosis; scutello subrotundato; elytris cordato-ovatis, striato-punctatis, fasciis duabus interruptis, antica arcuata ante medium sita, e pilis densis niveis formatis, ornatis; corpore infra pedibusque sat sparse longe niveo-pilosis. Long. 3 lin.

Hab. Queensland (Rockhampton).

Tragopus plagiatus. Pl. I. fig. 7.

T. oblongus, utrinque cylindrico-conicus, fuscus, parce silaceo-squamosus; capite rostroque sat dense omnino squamosis; antennis piceis; funiculo articulis duobus basalibus æqualibus, tertio subconico, præcedentis dimidia longitudine; oculis tenuiter granulatis; prothorace conico, utrinque perparum rotundato, basi vix bisinuato; elytris basi prothorace vix latioribus, postice gradatim parum latioribus, supra valde convexis, fere obsolete foveatis, transversim interrupte undulato-granulatis, singulis plagis duabus pallidioribus, una ante alteram fere obsoletam pone medium, notatis; corpore infra nigra maculis silaceis lateraliter notato; femoribus subtus dento minuto armatis, posticis abdomen haud superantibus. Long. 6 lin.

Hab. Queensland.

The outline of this species is somewhat different from that of *T. asper* and its congeners. One of the latter from Java, and a very near ally, has coarsely facetted eyes. A good generic character may be found occasionally to be only of specific value.

Imaliodes nodulosus.

I. ovatus, niger, squamulis griseis suberectis sat dense tectus; rostro capite fere duplo longiore; antennis piceis; funiculo articulis duobus basalibus longitudine æqualibus, tertio quartoque conjunctim præcedente brevioribus; prothorace utrinque fortiter rotundato, antice valde constricto; scutello transverso; elytris breviter ovatis, sulcato-punctatis, interstitiis, posticis exceptis, nodis elevatis 2-4 singulatim munitis; femoribus modice incrassatis, anticis dente minuto instructis; tarsis articulo ultimo subtestaceo, sparse piloso. Long. 3 lin.

Hab. Rockhampton.

This species differs from its two congeners in having a small but distinct scutellum, and in its nodulose elytra.

DRASSICUS.

Caput inter oculos subplanatum; *rostrum* mediocre, validum; *scrobes* præmedianæ, laterales. *Scapus* breviusculus, oculum haud attingens; *funiculus* 7-articulatus, articulis duobus basalibus longioribus, cæteris subturbinatis; *clava* distincta. *Prothorax* subconicus, apice productus, utrinque paulo rotundatus, basi truncatus vel perparum bisinuatus, lobis ocularibus distinctis. *Elytra* ovata, basi prothorace haud latiora, humeris nullis. *Pedes* validi; *femora* modice crassa, postica brevia; *tibiæ* breves, rectæ; *tarsi* breves, articulo tertio late bilobo; *unguiculi* liberi. *Rima* pectoralis pone coxas anticas terminata, apice fornicata. *Abdomen* segmento secundo amplo.

This genus differs from *Tragopus* in its short legs and thick femora, and from *Imaliodes* in the elytra not projecting beyond the prothorax at the base.

Drassicus nigricornis. Pl. I. fig. 3.

D. ovatus, convexus, niger, squamis griseis sat dense omnino tectus, aliis nigris erectis adspersus; rostro capite plus duplo longiore, versus apicem evidenter latiore; antennis piceo-nigris; funiculo articulis duobus basalibus æqualibus, reliquis conjunctim fere longioribus; prothorace in medio rotundato, antice cito, postice gradatim paulo angustiore, basi perparum bisinuato, lobis ocularibus prominulis; elytris orbiculato-ovatis, seriatim grosse punctatis, punctis plerumque squama antice laxe instructis; femoribus anticis dente minuto armatis. Long. 3½ lin.

Hab. Queensland.

Drassicus illotus.

D. præcedenti similis, sed squamositate crustacea sculpturam occultante supra tectus; articulo secundo funiculi quam primo evidenter longiore; prothorace apice magis producto, pone medium lateribus parallelis; corpore infra pedibusque sat dense griseo-squamosis; femoribus anticis dente acuto armatis. Long. 4 lin.

Hab. Queensland.

When the squamosity is removed, the punctation on the prothorax is seen to be nearly obsolete; on the elytra it consists of large, rather closely set foveæ.

AGENOPUS.

Poroptero **affinis, sed tarsis linearibus, infra nudis, sparse setosulo-marginatis, articulo tertio haud bilobo.**

The only other genus among the allies of *Poropterus* with linear tarsi is *Mormosintes*; but in that genus they are hispid or spongy beneath, as in *Poropterus*, and the femora are linear, and the eyes finely facetted. The species described below is exceedingly like *Poropterus musculus*; but, besides the generic differences, the base of the prothorax and the proportional sizes of the three intermediate abdominal segments will, *inter alia*, at once distinguish it.

Agenopus agricola.

A. ovatus, supra depressus, niger, indumento fusco, squamulis erectis setulisque raris nigris interjectis, indutus; rostro valido, sat breviusculo, rude squamoso; antennis subpiceis, funiculo articulis duobus basalibus longitudine æqualibus (primo crassiore), reliquis subturbinatis; prothorace latitudine paulo longiore, apice paulo producto, antice constricto, deinde rotundato, lateribus gradatim parum angustiore, basi fortiter bisinuato, lobis ocularibus distinctis, supra inæquali, fere obsolete foveato; elytris supra sat confertim leviter foveatis, basi circa scutellum elevatis, lateribus subparallelis, declivitate perparum latioribus, deinde sat abrupte angustioribus, apice late rotundatis, humeris paulo prominulis; corpore infra pedibusque remote rude punctato-squamigeris; abdomine segmento secundo duobus sequentibus conjunctim breviore; tibiis brevibus. Long. 3 lin.

Hab. Western Australia.

Nechyrus incomptus. Pl. I. fig. 9.

N. ovatus, supra depressus, niger, squamis erectis, plerumque fasciculatis, concoloribus vel fuscis, nonnullis griseis, adspersus; capite parvo; rostro prothorace vix breviore, dimidio apicali nitido, lateraliter sulcato, remote tenuiter punctulato; antennis piceis; scapo sat breviusculo, gradatim crassiore; funiculo articulis duo-

bus basalibus æqualibus, reliquis subturbinatis; clava breviter ovata; prothorace utrinque usque ad medium gradatim latiore, deinde lateribus parallelis, apice producto, supra basin versus late leviter excavato; scutello semiorbiculari; elytris oblongo-cordatis, rude remote punctatis, humeris modice prominulis, apice rotundatis, singulis tuberculis fasciculatis sex biseriatim obsitis; corpore infra remote punctato, punctis in fundo squamam griseam gerentibus; pedibus squamis elongatis asperrime vestitis; tibiis minus elongatis, rude squamosis. Long. 4–5 lin.

Hab. Queensland.

Near the Ceram *N. porcatus*, which has also shorter tibiæ, but, *inter alia*, with scattered foveate punctures on the elytra, instead of their being sulcate-punctured. This species has a resemblance to some species of *Poropterus*, from which genus, however, *Nechyrus* is known by the pectoral canal open at the apex and extending to the posterior part of the intermediate coxæ; from *Cnemargus*, to which I think it is most nearly allied among the genera known to Lacordaire, it is at once differentiated by its straight tibiæ.

Idotasia æqualis.

I. elliptica, nigra, nitida; rostro arcuato, basi fronteque lineis longitudinalibus acute elevatis; antennis piceis; oculis tenui-granulatis; prothorace sat fortiter vage punctulato, punctis squama nivea instructis; elytris subtilissime striato-punctulatis; femoribus parum incrassatis, muticis, vage lineatim albo-squamulosis; tibiis sulcatis, rectis, posticis intus subflexuosis. Long. 1⅔ lin.

Hab. Cape York; Rockhampton.

Near the Moluccan *I. elliptica*, but the prothorax less strongly and closely punctured, and the femora lineated but not toothed.

Idotasia evanida.

I. elliptica, nigra, nitida; rostro arcuato, basi fronteque lineis longitudinalibus elevatis; antennis piceis; oculis tenui-granulatis; prothorace sat tenuiter vage punctulato, punctis squamula minutissima instructis; elytris subtilissime striatis, vix punctulatis; femoribus haud incrassatis, sulcato-lineatis, muticis; tibiis sulcatis, rectis. Long. 1⅓ lin.

Hab. Queensland (Wide Bay).

Prothorax and elytra less strongly punctured than in the preceding, the latter with the least possible vestiges of punctuation, and the femora nearly linear; the posterior femora in this and its congeners, as well as in allied genera, have the upper margin densely covered with snowy-white scales. A figure of *Idotasia nasuta* is given in this Magazine, ser. 4.

vol. vii. pl. 16. fig. 2, which, the femora excepted, will give a good idea of the two species here described.

EXPLANATION OF PLATE I.

Fig. 1. *Sosytelus lobatus*; 1 *a*, side view of the head.
Fig. 2. *Agriochæta crinita*; 2 *a*, side view of the head.
Fig. 3. *Drassicus nigricornis*; 3 *a*, side view of the head.
Fig. 4. *Belus centralis.*
Fig. 5. *Acherres mamillatus*; 5 *a*, side view of the head.
Fig. 6. *Oditesus indutus*; 6 *a*, side view of the head.
Fig. 7. *Tragopus plagiatus.*
Fig. 8. *Ædriodes fastigiatus*; 8 *a*, side view of the head.
Fig. 9. *Nechyrus incomptus.*
Fig. 10. Side view of the head of *Misophrice hispida*; 10 *a*, tarsus of the same.
Fig. 11. Side view of the head of *Nechyrus incomptus* *.
Fig. 12. " " " *Oditesus buceros.*
Fig. 13. " " " *Amorphorhinus australis*, for comparison.
Fig. 14. " " " *Acantholophus Marshami*, ditto.
Fig. 15. " " " *Euomus insculptus*, ditto.
Fig. 16. Upper view of the head of *Phrenozemia lyproides.*
Fig. 17. Side view of the head of *Agenopus agricola.*
Fig. 18. Fore leg of *Œnochroma rubeta.*
Fig. 19. Tarsus of *Myrmacicelus exsertus*; 19 *a*, tarsus of *M. formicarius*, for comparison.
Fig. 20. Fore tarsus and part of tibia of *Sosytelus lobatus.*
Fig. 21. Fore tarsus and part of tibia of *Agenopus agricola* (unfortunately reversed).

XIII.—*Description, with Illustrations, of a new Species of* Aplysina *from the N. W. Coast of Spain.* By H. J. Carter, F.R.S. &c.

[Plate VII.]

There is a little family of purely horny sponges (that is, aspiculous, and without foreign objects in the core of the horny fibre) in which there are as yet only two genera mentioned, viz. *Aplysina* and *Luffaria.* For this family I propose the name of "Aplysinidæ," after Aristotle's term for certain sponges which he has described as follows:—

"There is also another species, called *Aplysia* (ἀπλυσία), because it cannot be washed. This has very large passages; but the other parts of the substance are quite compact. When cut open it is more compact and smooth than the sponge, and the whole is like a lung; of all the sponges this one is confessed to have the most sensation and to be the most enduring. They are plainly seen in the sea near the sponges; for the other sponges are white as the mud settles down upon them, but these are always black." (Hist. An., trans. by R. Cresswell, Bk. V. chap. xiv., Arist. V. xvi. 10.)

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* The lateral groove below the insertion of the scape, in a line with the scrobe, is made rather too much like the scrobe itself by the engraver.

How far Aristotle meant the sponges now called "*Aplysinæ*," or whether he included others among them under the general name of "*Aplysia*," it would be waste of time to discuss. Suffice it, therefore, to state that the description comes very near to the *Aplysinæ* of the Adriatic Sea at the present day, and that the name has thus been well chosen for such sponges.

On referring to Schmidt's invaluable work on the Sponges of the Adriatic Sea (1862, p. 25), we may there find that Nardo, in 1834 ('Isis'), first adopted the term "*Aplysinæ*" (originally named by him "*Aplysiæ*") for certain sponges, one of which he called *A. aërophoba*, and that Schmidt, in 1862, elucidated this species, in the publication to which I have just alluded, both by description and illustration—that is to say, that he added the *sine quâ non* for the identification of *Aplysina*, viz. the character of the fibre of which the skeleton is composed. So far, then, Schmidt has established *this* genus.

Now as regards that of *Luffaria*, which Schmidt has also accepted (Atlantisch. Spongienfauna, p. 30, 1870):—

In 1845 (Annals, vol. xvi. p. 403) Dr. Bowerbank described a sponge from the West Indies, which had been presented to him by Dr. Veronge, as follows: "This specimen is in the form of a cluster of cylindrical tubes about twelve inches in height and two in diameter, the thickness of the tube being about half an inch"—the skeleton of which is stated at the commencement of the description to be "composed of a network of keratose fibres inosculating in every direction without order. Fibre cylindrical, continuously fistular, without spicula. Cavity of the fibre simple."

No reference is made by Dr. Bowerbank to any previous authority—although one of the highest, viz. Esper, had figured this sponge in three plates successively in 1794 (Pflanzenthiere, tab. xx., xxi., and xxi. *a*), as confirmed by Dr. Ehlers in 1870 in his Synonymy of the Esperian Collection at the Museum of the University of Erlangen, wherein he identifies Esper's *Spongia fistularis* (that is, the one figured in the above mentioned plates) with the *Luffaria fistularis* of De Fonbressin and Michelotti, given in their descriptions and illustrations of the sponges of the Caribbean Sea (Natuurk. Verh. Holland. Maat. Wet. te Haarlem, vol. xxi. 1864); the latter authors having already, in their description and figure of this species (*op. cit.* p. 60, pl. 10. fig. 2), come to the same conclusion.

Dr. Bowerbank, it is true, named the species "*Verongia*," after Dr. Veronge, who gave him the specimen; and the fibre is well characterized by Lens Aldous's figure (Annals, pl. 13. fig. 7, *l. c.*), though much better, by the same artist, in Dr. Bowerbank's 'British Spongiadæ' (pl. 13. fig. 266, 1864); and so far the priority of "naming" is in favour of Dr. Bowerbank. But when we find Dr. Bowerbank in the following page identifying his "*Verongia*" in a fossilized state with the conferva-like glauconite "in the green agates, miscalled in commerce jaspers, from India" (which, to my certain knowledge, come from geodes in the decomposed trap of Western India), one cannot help being struck by the inferiority of mental power on the one hand and the sharp-sightedness on the other—much after the fable of the shoemaker who rose greatly in the estimation of the sculptor when he pointed out the absence of the shoe-string in his statue, but sunk lamentably in it afterwards when he made observations on the higher art.

So much for Dr. Bowerbank's part in the matter. Now let us direct our attention to the work of De Fonbressin and Michelotti (*op. cit.*), who collected the sponges of the Caribbean Sea *on the spot*, and described six species, with modest references to all those who seemed to have noticed the like before them—giving to the whole the generic name of "*Luffaria*," drawn from the great resemblance of the horny skeleton of these sponges to the fibrous mass of a species of the cucurbitacean genus *Luffa* which remains after the skin and soft parts have rotted away, and which they also state to be used in the "colonies" of the West Indies, where real sponges are not at hand. Further, we find that, recognizing the whole bearing of the family generally towards the rest of the Spongiadæ, elementarily (that is in the structure of the fibre) as well as *en masse*, they finally placed the genus in the third tribe of their second family of sponges, under the designation of "*Spongiæ homogenæ.*"

Is it extraordinary, then, after contrasting thus the value of the contributions to our knowledge of this genus, respectively named by Dr. Bowerbank and the authors last mentioned, that we should find Schmidt (Atlantisch. Spongienfauna, p. 30) ignore the former altogether, and accept the name of "*Luffaria*," given to this genus by De Fonbressin and Michelotti? nor resting here, but also synonymizing Dr. Bowerbank's *Verongia zetlandica*, not with *Luffaria* (that is, Dr. Veronge's West-Indian sponge above quoted), but with his (Schmidt's) *Cacospongia*, which has a totally different fibre, the cavity of which, instead of being simple, is charged more or less with foreign objects, *i. e.* grains of sand and fragments of spicules.

I might here add too, as regards sponges hitherto considered to have a skeleton possessed of simple, solid fibre *only* (that is, without core of any kind), that I very much doubt if there be many such, since, in the softest officinal sponge, to say nothing of the coarser kind, it is hardly possible to pinch out the minute portion which is required for microscopic examination without finding in it a filament also possessed of an axis containing fragments of spicules and grains of sand. It is true that the solid fibre is greatly in excess of this, and that the softest sponges have most of it; but this does not release us from the necessity of grouping these sponges among the Hirciniadæ, wherein the character of the fibre is to possess an axis formed more or less of the fragments of spicules, minute grains of sand, and other foreign objects of the like nature.

While the *Aplysinæ* have as yet been chiefly found in and about the Mediterranean Sea, the *Luffariæ* appear to have come almost exclusively from the West Indies and their neighbouring seas.

In Dr. Schmidt's work on the Sponges of the Adriatic Sea, to which I have already referred, based on the examination of specimens which he himself dredged up, described with the power of a professor of zoology, and illustrated with great ability by skilful naturalists, two species of *Aplysinæ* are mentioned, viz. *A. aërophoba*, which is Nardo's name and form, and *A. carnosa*, which is Dr. Schmidt's new species. Good specimens of the former were sent to the British Museum by Dr. Schmidt, where they now represent the type specimen of this species; and the same species would appear to exist in the Gulf of Florida (Atlantisch. Spongienfauna, p. 30, pl. 3. fig. 16); while De Fonbressin and Michelotti, as before stated, give six species of *Luffaria* (*op. et loc. cit.*), of which there is also an abundance of very fine specimens in the British Museum.

It is, however, with the former genus, and not with the latter, that we are here chiefly concerned, as we have to add a new locality to *A. carnosa* and a new species to the genus, from specimens dredged up by W. Saville Kent, Esq., of the British Museum, in Vigo Bay, while on board the yacht 'Norna,' in 1870, and now handed over with the rest of his valuable collection to the British Museum.

To Mr. Kent, therefore, we are indebted for the new species of *Aplysina* which I am about to describe under the designation of "*corneostellata*," on account of the skeleton chiefly consisting of horny stellates; and the specimens have been so successfully preserved in spirit, that I shall not only be able to describe the ova with which they happen to be charged, but also the spongozoa which now and then appear in groups with portions of the sponge placed under the microscope for examination (as may be seen by reference to Pl. VII. fig. 12), pointing out the interesting fact that the kerataceous sponges possess the same kind of spongozoon as the rest.

Aplysina corneostellata, n. sp. Pl. VII. fig. 1.

Sessile, spreading, massive, rising into short lobes terminated by mammiform conical extremities, each bearing a large vent (fig. 1, *b b*; 2, *b*). Colour pinkish violet or flesh-colour. Surface smooth, minutely aculeated, each aculeation (fig. 2, *a*) terminated by the projection of a single horny hair-like filament (fig. 3, *a*). Internal structure cancellous, fleshy, permeated by branched systems of excretory canals, which finally end in the large vents at the summits of the mammiform eminences respectively; the whole supported on a horny skeleton composed of 5–6-rayed stelliform structures (fig. 4, *c c c c c*), one arm of which, when near the surface, projects through an aculeation (fig. 3, *ac*), and the rest, where they are in contact with the rays of neighbouring stellates, united to the latter by a thin expansion of transparent horny matter (fig. 4, *d d d*), which thus, altogether, forms a continuous skeleton supported on a few stem-like filaments at the base, which are united to the object on which the sponge may be growing (fig. 4, *b b b*). Horny filament hollow, the core consisting of fine granular matter *only*, with here and there parabolical wave-like lines, whose convexities are directed towards the end of the filament (figs. 5 & 6); diameter of the core much exceeding the thickness of the horny tube (fig. 7).

Dermal structure consisting of a thin transparent layer of sarcode (fig. 3, *c*; 9, *a a*), in which the pores may be observed by the aid of a microscope to be situated in variable plurality over the interstices of a subjacent network (fig. 8, *a*, *b*; 9, *c*) composed of elongated fusiform granuliferous cells adhering together in a cord-like form (fig. 10, *b*), which contrasts strongly with the globular form of the granuliferous cell in the overlying dermal sarcode (fig. 11); both structures covering the whole of the sponge up to the brink of the vents, and by their transparency exposing the cavities of the cancellous structure beneath, whose dark round cavities thus appear like so many minor vents opening upon the surface generally.

Body charged with spherical ova (fig. 4, *g g g*) of a deeper colour than the rest of the substance, presenting on pressure under the microscope a homogeneous, transparent, capsular envelope, within which is a more delicate one filled with nucleated granuliferous cells suspended apparently in a grumous dark brown-red coloured plasma (fig. 13), in which may also be observed a few colourless, semiopaque, albuminoid concretionary masses, each of which, too, seems to be in a cell.

The spongozoa may now and then be also observed in aggregated groups with the rostrum and cilium extended, together with two ear-like projections, one on each side of the cilium, indicative of the remains of the "collar" (fig. 12).

Size of specimen varying with that over which the sponge may be growing, the one figured about 1 inch long by half an inch thick; horny stellates about 1-15th, ova about 1-120th, and spongozoon about 1-3000th of an inch in diameter respectively.

Hab. Marine, growing over the shells of living mussels (*Modiola albicosta* ?) and on the empty shells of *Solen*.

Loc. Cies Islands, Vigo Bay (W. S. Kent, Esq.).

Obs. The chief distinguishing character of this species is the stellate form assumed by the filaments of the horny skeleton. It also differs from the specimen of *A. carnosa* dredged up by Mr. Kent in the same locality in the following particulars. *A. carnosa* is more fleshy, solid, and smooth, has no part of the horny skeleton projecting through the aculeations or any other part of the surface; no appearance of holes or small vents on the surface, from the dermal sarcode being too thick and opaque to allow the cavities of the cancellous or areolated structure beneath to be seen through it; and, for the same reason, here and there, where the surface is reticulated, the reticulations are more like superficial rugæ; the mammiform projections are flattened, and the vents sunk in the centre instead of being at the end of conical eminences as in *A. corneostellata*. In short, altogether *A. carnosa* is a coarser form with a dark violet colour and opaque appearance.

I have not seen a portion of *Luffaria* that has been preserved in the wet state; but we learn from De Fonbressin and Michelotti (p. 58, *op. cit.*) that they are all black, brown, or yellow—and when dry *all* black, which is the case with those in the British Museum on which the sarcode still remains. The sarcode is black, or, rather, blue-black now, more like the colour of ink, and the colour of the horny fibre more or less brown or yellow. When the latter is transparent and held between the eye and the light, it presents an amber-like appearance with a whitish core in the interior, round like the fibre, but very much less in diameter than the thickness even of the wall of the fibre.

The opposite of the latter is the case with the *Aplysinæ* (see fig. 7); and herein, together with their sessile spreading growth and comparatively diminutive size, they contrast greatly with the comparatively gigantic tubular forms of *Luffaria* (whence the original designation of "*fistularis*"), which, as yet, have only been found in the seas between the two Americas.

I have stated that the network (figs. 3 & 8) subjacent to the dermal sarcode in *A. corneostellata* "is composed of elongated fusiform granuliferous cells aggregated together in a cord-like form" (fig. 10, *b*); but this assertion, so far as the individuality of the cells is concerned, rests on the conjecture that each elongated group of granules represents a distinct sponge-cell. Whether, however, the cord-like form is produced by the mere contact of these cells, or they are thus united by an intervening sarcode, I know of no means to determine. Certain it is that, if they possess the same polymorphic power as the soft parts of the sponge generally, this network must afford considerable support to the whole structure, and thus also yield to that of the dermal sarcode about it, whose polymorphic power we know to be such in *Spongilla* that it can extemporize and close pores in its substance wherever and whenever requisite.

The ova, so far as my examination extended (and I examined many), did not appear to have gone beyond cell-multiplication; that is to say, none presented rudiments of the horny structure like unto the development of spicules in the ova of the spiculiferous sponges at this period. What the colourless albuminoid concretions may be which I have not figured I am not able even to conjecture.

The spongozoa presented nothing further than the passive form above described.

Sudden death, by immersion in a preservative fluid during active life, would seem more calculated to cause many polymorphic parts of the sponge to retain their active forms than gradual death. At the same time it cannot be ignored that the pores in the dermal sarcode, which is as polymorphic as any other part of the sponge, do appear to be retained under any circumstances, as if, instead of being merely extemporaneous, they had been *established* holes endowed with a sphinctral power of contraction or dilatation as required.

As regards increase of the horny element of the skeleton during the *general growth* of the sponge, a cell was often observed to be fixed to the side of a ray of one of the stellates by a transparent film of a horny nature, apparently extended over it from the surface of the ray itself (fig. 4, *e*; 5, *c*). In some instances this cell was observed to have undergone increase in size, elongation, and the addition of concentric horny layers to its circumference (fig. 5, *d*); while in others it was observed to have put out several points or buds, as if about to grow into a stellate (*e*).

On the other hand, a ray was sometimes observed to present a young branch (fig. 6, *c*) whose medullary or central cavity was in continuation with that of the ray on which it was situated.

Occasionally a grain of sand (fig. 4, *f*) was seen to be attached to a horny filament after the manner of the cell, and some of the stem-like filaments towards their base of attachment had a grain or two of sand in their centre. But these must be regarded as accidental occurrences; for the structure generally is not only devoid of proper spicules (that is, of spicules formed by the sponge itself), but the cavity of the horny fibre is equally devoid of grains of sand, fragments of spicules, or any other of the minute objects which are so characteristic of that in the Hirciniadæ.

The subdermal network appears to be common to most of the kerataceous sponges, attaching to itself through the dermal sarcode, in some of the *Hirciniæ*, a number of minute objects, so as to present a white lacework between the aculeations, which is visible to the naked eye, and which, when mounted in Canada balsam and viewed with a microscope, resolves itself into an infinite variety of entire spicules, both siliceous and calcareous, together with fragments of the same and grains of sand—altogether forming a most inviting, instructive, and interesting study to the spongologist. This lacework is particularly well developed in many of the great *Hirciniæ* at the British Museum which have been collected from the West-Indian seas and the coast of Southern Australia, as well as in the little specimen of *H. variabilis* from the Adriatic Sea, presented by Dr. Schmidt. In some of the kerataceous sponges the network is horny, in the spiculiferous sponges spiculiferous; in short, more or less modified in all, it supports the dermal sarcode, in which the pores, in variable plurality, find themselves conveniently placed opposite the interstices. Thus the two combined form the pore-structure, which is often as beautiful as it is characteristic of the species.

I would also here add, with reference to the parasites of sponges, that on one of the specimens of *Aplysina corneostellata* are a number of minute isolated Ascidians attached to the dermal sarcode, which, from their dark red colour, looking like so many blood-red points, appear to have derived this tint in some way from the colouring-matter of the *Aplysina* on which they were growing, as there is a portion of an *Esperia* in the same collection, and dredged up from the same locality, on which there is an equal amount of the same species of Ascidians similarly situated, but without any colour at all, or, at all events, any more than that of the *Esperia* on which they were growing, which merely presents the grey tint of colourless sarcode. The granuliferous cells represented in the dermal sarcode of fig. 9 might also well stand for the appearance and relative size of these Ascidians.

EXPLANATION OF PLATE VII.

Fig. 1. *Aplysina corneostellata*, n. sp., nat. size, growing on the shell of a living mussel (*Modiola albicosta* ?); colour pink-violet or flesh-colour: *a*, shell; *b b*, vents.

Fig. 2. The same, one of the mammiform eminences, magnified, to show the position of the vents and general character of the aculeated surface: *a*, rays of horny stellates projecting beyond the summits of the aculeations; *b*, vent, showing its division into smaller vents within.

Fig. 3. The same, single ray, still more magnified, to show the manner in which the dermal sarcode hanging upon it tent-like forms the aculeation: *a a*, ray; *b*, centre of horny stellate; *c c*, subdermal reticulated structure covered by the transparent dermal sarcode.

Fig. 4. The same, corneo-stellate fibre and ova, magnified 15 diameters: *a*, foreign object on which the stem-like filament (*b b b*) is growing; *c c c c c*, corneo-stellates; *d d d*, thin expansions of horny matter uniting the rays together; *e*, cell enclosed under an expansion of horny matter; *f*, grain of sand enclosed under an expansion of horny matter; *g g g*, ova.

Fig. 5. The same, portion of ray of stellate, much magnified: *a*, cortical or horny tube; *b b*, core or interior presenting parabolical wave-like lines, with their convexities directed towards the free extremity of the ray; *c*, cell enclosed under a thin expansion of horny matter; *d*, the same, enlarged and elongated, with the addition of concentric horny layers round the cell, which now becomes the core; *e*, the same, putting forth five buds, corresponding with the number of rays in the stellate. Diagrammatic.

Fig. 6. The same, extremity of ray, much magnified, to show the commencement of a branch whose core is connected with that of the ray: *a*, cortical or horny tube; *b*, core; *c*, branch; *d*, thin expansion of horny matter covering the branch.

Fig. 7. The same, piece of horny fibre, still more but proportionately magnified, to show the relative thicknesses of the core and cortical tube, also that the latter is formed of layers: *a*, cortical tube; *b*, core.

Fig. 8. The same, portion of the dermal surface, magnified, showing:—*a*, the subdermal reticular structure; *b*, the interstices in which the pores are situated.

Fig. 9. The same, a single interstice, much magnified, and partly covered by the dermal sarcode in which the pores are seen and situated: *a a*, dermal sarcode, apparently homogeneous, charged more or less with globular granuliferous cells, also bearing (*b b*) the pores; *c*, interstice or mesh of the subdermal reticulated structure or network.

Fig. 10. The same, portion of the subdermal reticulated structure, greatly magnified, to show that it is composed of elongated fusiform granuliferous cells united into the form of a cord: *a a*, cord; *b*, elongated groups of granules representing elongated fusiform sponge-cells.

Fig. 11. The same, form of the globular granuliferous cells of the dermal sarcode, to contrast with the elongated forms in fig. 10.

Fig. 12. The same, three spongozoa, much magnified, each about 1-3000th inch in diameter.

Fig. 13. The same, ovum much magnified, showing:—*a*, capsule; *b*, ovicell filled with nucleated granuliferous cellules suspended in a dark red grumous matter.

XIV.—*Descriptions of two new Sponges from the Philippine Islands.* By H. J. CARTER, F.R.S. &c.

THE two following Sponges, obtained at Cebu, one of the Philippine Islands, by Dr. A. B. Meyer, and now the property of the British Museum, are herewith described at the request of Dr. J. E. Gray, pending their further description and future illustration elsewhere.

1. *Meyerina* (nov. gen.) *claviformis*, Gray.

Specific character.—Sarco-spiculous. General form long, conical, cucumber-like, slightly bent upon itself. Colour now (that is in its dried state) light sponge-yellow. Cylindrical at the base, where the yellow colour ceases, and the structure is extended by bundles of long, colourless, glassy spicules, which were continued downwards for several inches into the sandy mud in which the sponge grew, while they pass upwards in an oblique network, longitudinally, to the middle of the body, whence they are continued on, by repetition, to terminate at the apex in short naked tufts round the cloacal orifice of the sponge, like those at the root, to which they thus bear a miniature resemblance. Surface even towards the base, becoming angular in the middle third by the projection of long ridges, which, uniting longitudinally, leave lozenge-shaped intervals as they gradually subside towards the apex. Vents chiefly on the ridges, in large *circular* network, and here and there in the intervals, which, on the other hand, are occupied by a small *rectangular* network, in the interstices of which are the pores. Internal structure rigid, reticulate, largely canalo-areolar, especially towards the surface, interwoven with the longitudinal spicules before mentioned, and surrounding a long, fusiform cloacal cavity, which commences about four inches from the base, and, increasing gradually in size to about the middle of the body of the sponge (where it is an inch in diameter), then diminishes again towards the apex, where it terminates in an orifice about one sixth of an inch wide; permeated on all sides by the canals of the areolar structure, which open into it. Spicules of *ten* kinds, viz.:—1st, of the root: *a*, long, smooth, large, ends pointed above, broken off below; *b*, long, spined, small, ends pointed and smooth above, anchor-shaped below; spines recurved, alternate, ceasing just before they arrive at the lower extremity, which is two-armed, opposite. 2nd, of the ridges or vent-areæ: *c*, nail-like, head consisting of four short arms extended horizontally and at or nearly at right angles to each other, situated on a long vertical shaft; *d*, thin, straight, acerate, fusiform-spined, situated in bundles round and projecting beyond the former; spines directed inwards, almost vertical and recurved at first, becoming afterwards nearly parallel with the shaft; *e*, anchor-headed ("birotulate"), large, with straight tubercled shaft and eight arms at each end, equally long, directed towards the middle of the shaft and arranged at equal distances (somewhat spreading) from each other around each end, very numerous, and bespangling the surface of the vent-areæ with the outermost head; *f*, crucial-headed, with long spined shaft; arms of the head short, one or two blunt-spined, abruptly ended, slightly curved in opposite directions (*i. e.* slightly sigmoid); shaft densely armed a little below the head with long, stout, recurved spines on all sides, bottle-brush-like; in great numbers round the vents, with their heads applied to the horizontal arms of *c*, and their spined shafts projecting outwards so as to form a fringe round the vents, capable of thus closing them when required; *g*, anchor-headed, minute, resembling a miniature form of *e*, charging the sarcode in great numbers round the arms of *c*, and, indeed, everywhere; *h*, hexaradiate, minute, each arm bearing a few long spines towards its extremity, the rest smooth; numerous in the sarcode, and characteristic of the species; *i*, acerate, fusiform, minute, bearing four large spines opposite and nearly vertical in the centre, and a few others sparsely scattered over the rest of the shaft, chiefly towards the ends, numerous and characteristic. 3rd, of the pore-area: *k*, like *c*, but with longer horizontal arms and shorter vertical shaft; *l*, like *f*, but with shorter shaft; *m*, the same as *e*, but not so abundant as in the vent-area; *n*, like *g*, but more plentiful here. Spicule of the tufts at the apex spined towards the free end, with the spines directed *outwards*. Spicules of the internal structure a mixture of those above described, with the arms of the crucial-headed one greatly extended.

Size of specimen: total length 18 inches. From the apex to the commencement of the root-spicules 15 inches; root-spicules 3 inches (probably six or more if the whole were present entire and extended, instead of being wrapt up in a bunch as they now are); diameter in the centre 2 inches; cylindrical portion between the root and the ridges 1½ in diameter by 3 inches long.

Hab. Marine, growing erect in sandy mud.

Loc. Cebu, one of the Philippine Islands (Dr. A. B. Meyer).

Obs. The spicules *a*, *c*, *e*, *g* closely resemble similar ones in *Carteria* and the glass-cord respectively; *f*, although common to *Carteria* and *Holtenia*, more closely resembles this spicule in the latter; and *b* is almost identical with the long root-spicule of *Holtenia* and *Pheronema Grayi*; *h* and *i* are peculiar to the species—that is, not found in either of the other sponges mentioned. The common, long, acerate fusiform spicule with central canal-cross and inflation is apparently absent here, together with the rarer spined crucial spicule of *Hyalonema*, as is apparently the case in *Holtenia*; so that our sponge is a mixture of *Carteria*, *Holtenia*, and *Pheronema*, which shows that they are all three closely allied.

This is the most exquisite sponge that I have yet examined as a whole and in its parts. Individually its spicules equal any in beauty of form, and collectively surpass all. Its general form has been shortly described by Dr. J. E. Gray, under the name of *Meyerella claviformis*, in the last number of the 'Annals' (p. 76); but Dr. Gray has now changed "*Meyerella*" to "*Meyerina*," having discovered that the former has been already used for something else.

2. *Crateromorpha* (nov. gen.) *Meyeri*, Gray.

Specific character.—Sarco-spiculous. General form globular, wide, ovate, truncated, hollow, supported on a contracted stem, goblet-shaped. Colour light sponge-yellow in its dried state. Margin of the brim extemely thin, thickening towards the base. Covered externally throughout with a fine reticular structure of square meshwork, in the interstices of which the pores are situated. Vents on the inner side of the cup enormously large at the bottom, becoming smaller towards the brim. Internal structure dense, permeated by inosculating canals, which respectively open by the vents into the inner side of the cup, and appear beneath the reticular structure externally. Stem long, round, contracted, compound, fistulous—that is, consisting of a dozen longitudinal canals imbedded in a felt-like disposition of the spicules, which canals open into the vents at the bottom of the cup where the stem joins the latter; stem becoming dispersed at the other end, where it disappears in a fibrous mass into the sandy mud in which the sponge grew. Spicules of five kinds:—1st, of the head: *a*, straight, fusiform, inflated and spined at the ends, also inflated more or less and smooth in the centre, where the central canal has a hexaradiate cross, opposite to the ends of which there may be two or four tubercles; this is the staple form of the spicule of this sponge; and by intercrossing each other in bundles at and about right angles they support the dermal reticular structure above; *b*, nail- or crucial-headed, scanty; arms smooth, straight and pointed, the shaft a little longer than the rest—among the foregoing, but chiefly visible at the base of the sponge on the outside about the point where the stem joins the cup—supporting, together with *a*, the dermal reticular structure; *c*, hexaradiate, *minute*, smooth, each arm of the cross, immediately after leaving the centre, separating into two long, divergent spines, in myriads throughout the sponge. 2nd, of the pore-area: *d*, nail- or crucial-headed, arms parting at right angles from the centre, more or less inflated at the ends, and spined throughout; shaft a little longer than the rest, also spined and more or less pointed; arms of this spicule spreading out horizontally to reach the centres of the adjoining crosses, and thus together forming the rectangular dermal network. 3rd, of the stem: *e*, the same as *a*, forming a felt-like mass, in the midst of which are the long fistular canals; *f*, the nail-head spicule *b*, chiefly found about the part mentioned; *g*, large, smooth, thick spicules 4-12ths of an inch in length, acuate, inflated at both ends, fusiform and acerate respectively, distributed longitudinally over the surface of the stem.

Size of specimen: widest part of head 3½ inches, aperture 2¾ by 1¾ inches; depth of cup 2¼ inches; length of head outside 3¾ inches; greatest thickness of walls 14-12ths of an inch; length of stem 3½ inches, diameter of stem 7-12ths.

Hab. Marine, growing erect in sandy mud.

Loc. Cebu, one of the Philippine Islands (Dr. A. B. Meyer).

Obs. This is entirely a new genus, although, as will hereafter be seen, some of its spicules are almost identical with those of *Rossella philippinensis*, Gray (to be described hereafter), which comes from the same locality and is also cup-like, but is fixed to the bottom by a number of bundles, or tail-like extensions from the base, of long, stiff spicules, bearing at their extremities the four-armed recurved head which I have already given ('Annals' for June 1872, p. 414, pl. xxi.) as an essential character of this genus.

XV.—*On two new Species of Birds.*

By John Gould, F.R.S. &c.

About twenty years ago I obtained two specimens of a *Dicæum*, one labelled Manila, the other Mindanao, which, although not quite certain, I believe to be the opposite sexes of an undescribed species, and now propose to characterize as

Dicæum retrocinctum.

Male (from Manila).—Head, neck, back, wing-coverts, tail, sides and centre of the throat, and a broad stripe down the centre of the breast steel or bluish black; a semicollar at the base of the neck behind, a small stripe down the chin, and a broader and longer stripe down the centre of the abdomen scarlet; under tail-coverts white; wings slaty black; sides of the chest and the abdomen white, passing into silvery grey on the flanks; bill black, lighter at the base; feet apparently dark brown.

Total length $3\frac{1}{2}$ inches; bill $\frac{5}{8}$, wing 2, tail $\frac{7}{8}$, tarsi $\frac{1}{2}$.

Female (from Mindanao).—Like the male on the upper surface, but wanting the red at the base of the neck; chin and throat white; remainder of the under surface grey, fading into white on the abdomen, down the centre of which is a stripe of scarlet as in the opposite sex; under tail-coverts white.

Size the same as that of the male.

Colluricincla parvissima, Gould.

Crown of the head, all the upper surface, including the wing-coverts and tail, olivaceous brown; wings rufous, their inner webs brown; over each eye a narrow line of buff; chin pale buffy, with a very faint stripe of brown down each feather; all the under surface rich buff or fawn-colour; bill light horny, darker above; legs and feet pale fleshy brown.

Total length $6\frac{1}{2}$ inches; bill $\frac{7}{8}$, wing $3\frac{1}{2}$, tail $2\frac{3}{4}$, tarsi $\frac{15}{16}$.

Hab. Rockingham Bay, Eastern Australia.

Remark. This bird is by far the smallest species of the genus I have yet seen, as is implied in the name I have applied to it, in contradistinction to *C. parvula.* In colour it differs from the latter in the buff mark over the eye, in the rufous colouring of the wings, and especially in the rich rufous tint of the under surface, which is even deeper in hue than the same part in *C. rufigaster*: the three species are, in fact, nearly allied.

XVI.—*List of Echinoderms collected by* Robert M'Andrew, Esq., F.R.S., *in the Gulf of Suez in the Red Sea.* By Dr. J. E. Gray, F.R.S. &c.*

Savigny, who accompanied the French Expedition to Egypt, drew and engraved in the most beautiful and elaborate style the Echinoderms that were collected during that Expedition.

They form part of the plates of the magnificent imperial but most useless work that is usually called the great work on Egypt. This work, though published at the commencement of the present century, is hardly known to scientific zoologists, and is rarely to be seen out of the great public libraries. So much is this the case, that on my showing the details of a species figured in it to a well-known Scandinavian zoologist, he inquired what work it was, he had never seen or even heard of its existence.

There are many species figured in the zoological portion of it that are as yet unknown and unnamed; and many of the microscopic peculiarities of the species that are there figured are being every now and then produced as modern discoveries; and there are yet others still to be described as new.

It is truly a "work of luxury" and not for scientific utility, though it contains, as I have observed, most accurate details which were far in advance of the scientific knowledge of the period, and in some respects of the present time†; but the great expense of the work and its immense size have rendered it almost a closed book to scientific men.

Unfortunately M. Savigny became blind before he was able to complete the descriptions of the animals and refer to the details on the plates of the Echinoderms; indeed he only published the descriptions of the Annelides and the Ascidia.

Professor Victor Audouin published an "Explication sommaire des planches des Echinodermes" and other divisions of the animal kingdom that had been drawn and engraved under Savigny's directions.

Unfortunately he does not seem to have had at his disposal the original specimens figured for sheet 1; and he observes, "En comparant les figures 1, 2, et 3 aux espèces représentées

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* This manuscript was prepared and written soon after Mr. M'Andrew's return; but being left on my writing-table during my temporary illness, it was carefully put away by my attendant, along with a quantity of manuscripts on Bats (where it was not looked for), and was only accidentally found a few weeks ago.—J. E. G.

† This is particularly the case with the Sponges, the texture of the mass and the spicules of each species as seen under the microscope being exhibited in detail.

par Müller on leur trouve plusieurs fois des ressemblances avec l'*Ophiura fragilis* et l'*Ophiura tricolor* de M. de Lamarck, mais il seroit difficile de donner une détermination positive" (p. 206).

Now that specimens have been obtained from the Red Sea and the coast of Syria, it is found that many of the species represented by Savigny are different from those to which Audouin referred them; but as yet I have not been able to compare the species of that family with the published work on them as carefully as I could have wished; and it is better they should remain until Dr. Perceval Wright, who has undertaken to make an examination of the Echinoderms in the Museum, with some other naturalists who have paid special attention to this group of animals, have examined and compared them.

I here give a list of the plates and the explanations as far as they are referred to:—

Savigny, Echinodermes de l'Egypte.

Tab. 1. figs. 1, 2. Comatules. Multiradiata, *Aud.* 105. Comatula Savignii, *J. Müller.*
fig. 3. Ophiura echinata, *Aud.* 106. Ophiolepis dubia, *Müller & Troschel.*
Tab. 2. fig. 1. Ophiures. O. fragilis, *Aud.* 106.
fig. 2. ——. O. fragilis, *Aud.* 106.
fig. 3. ——. O. tricolor, *Aud.* 106.
fig. 4. ——. O. squamata, *Aud.* 107. Ophiolepis Savignii.
Tab. 3. Asterias Savignii, *Aud.* Luidia Savignii. B.M.
Tab. 4. fig. 1. Asterias aurantiaca, *Aud.* 108. Astropecten.
fig. 2. A. calcar, *Aud.* 108. Asteriscus pentagonus.
fig. 3. A. seposita, *Aud.* 108. Rhopia seposita. B.M.
Tab. 5. figs. 1, 2. A. mamillata, *Aud.* 109. Pentaceros mamillata.
Tab. 6. Oursins. Cidarites Savignii, *Aud.* 110.
Tab. 7. fig. 1. ——. C. baculosa, *Aud.* 110.
fig. 2. ——. Echinus pallidus, *Aud.* 110.
fig. 3. ——. Scutella bifissa, *Aud.* 110. B.M.
fig. 4. ——. Spatangus crux-Andreæ, *Aud.* 111.
fig. 5, 6. ——. S. canaliferus, *Aud.* 111.
Tab. 8. figs. 1–5. Holothures, sp.

I have made a list of all the species which I have found recorded as inhabiting the Red Sea, and marked those that have been collected by Mr. M'Andrew, and those that are in the British Museum from other sources.

I have added a few notes formed on the examination of Mr. M'Andrew's specimens.

Fam. **Comatulidæ.**

Comatulides et *Comatuliens*, Dujard. & Hupé, pp. 186, 191.
Comatula, Lamk.

Comatula Savignii, J. Müller; Dujard. & Hupé, p. 203.

Echinoderme, Savigny, Egypte, t. 1.
Comatula multiradiata, Aud. Expl. pl.
—— *adeonæa*, Blainv. Man. d'Actin. p. 249, t. 26.

Arms twice or three times forked at the base, with more than twenty secondary or tertiary arms.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Fam. **Ophiuridæ**, Gray, Syn. B. M. 1840, p. 63.

Ophiurides, Dujard. & Hupé, p. 219.

Ophiolepis dubia, Müller & Troschel, p. 94; Dujard. & Hupé, p. 240.

Ophiura, Savigny, Egypte, t. 1. f. 3.

Hab. Red Sea.

Ophiolepis Savignyi, Müller & Troschel, p. 95; Dujard. & Hupé, p. 240.

Ophiura, Savigny, Egypte, t. 2. f. 4, 5.
—— *squamata*, Aud. Expl. p. 107.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Ophiolepis annulosa, Müller & Trosch. p. 89, t. 8. f. 4; Dujard. & Hupé, p. 236.

Ophiura annulosa, Blainv. Man. d'Actin. t. 44 (not Lamk.).

Hab. Red Sea.

Ophiolepis cincta, Müller & Trosch. p. 90; Dujard. & Hupé, p. 237.

Hab. Red Sea.

Ophiura brachyura.

Body smooth, without shield or spines, white-lined; arms short, thick, tapering; lateral spines elongate.

Hab. Gulf of Suez (M'Andrew). B.M. no. 2.

Not in Savigny: arms much shorter than any there figured.

Ophiura ——? (Not in good state.)

Disk with small spicules; lateral spines short, thick, not larger than diameter of arms.

Hab. Gulf of Suez (M'Andrew). B.M.

Not figured in Savigny's 'Egypte.'

Fam. **Asteridæ.**

Asterides, D. & H. p. 307, 1862.

Rhopia seposita, Gray.

Asterias seposita, Retz. Vetensk. Akad. iv. p. 337; Aud., Müller and Troschel.
Cribella seposita, Dujard. & Hupé, p. 354.
Asterias, Savigny, Echinod. Egypte, t. 4. f. 3.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Linckia typus, Gray, Ann. & Mag. N. H.

Asterias lævigata, Linn.
Ophidiaster miliaris, Müller & Troschel, p. 30, t. 2. f. 2; Dujard. & Hupé, p. 360.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Gomophia ægyptiaca, Gray, Ann. & Mag. N. H. 1840, vi. p. 286; see Martens, Wiegm. Arch. 1866, p. 62.

Hab. Red Sea. B.M.

Asteriscus pentagonus, Dujard. & Hupé, p. 378; Seba, t. 5. f. 19 (cop. E. M. t. 100. f. 3?)

Asterias calcar, Aud.; Savigny, Echinod. Egypte, t. 4. f. 2.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Asterina Burtonii, Gray, Ann. & Mag. N. H. 1840, vi. p. 289.

Asteriscus vermiculatus, Müller & Troschel.
Asterina gibbosa, Martens, Wiegm. Arch. 1866, p. 72.

Hab. Red Sea (J. Burton). B.M.

Pentaceros ——?, Savigny, Echinod. Egypte, t. 5. figs. 1, 2.

Asterias mamillata, Aud. Expl. p. 209.
Oreaster mamillatus, Müller & Troschel, Syst. Ast. p. 48; Dujard. & Hupé, Echinod. p. 383.

Back reticulated; margin spinose.

Var. Reticulation of the back more obscure, more closely covered with granulations; the margin not spinose.

Hab. Red Sea (Savigny); Gulf of Suez (M'Andrew). B.M.

? *Pentaceros tuberculatus.*

Oreaster tuberculatus, Müller & Troschel, Syst. Ast. p. 46; Dujard. & Hupé, Echin. p. 381.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Goniaster Sebæ, Gray, Ann. & Mag. N. H. vi. p. 28.

Goniodiscus Sebæ, Müller & Troschel, Syst. Ast. p. 58; Dujard. & Hupé, Echin. p. 402; Seba, Thesaur. t. 6. f. 7, 8.

Hab. Red Sea.

Astropecten polyacanthus, Müller & Troschel, Syst. Aster. p. 69, t. 5. f. 3; Dujard. & Hupé, Echin. p. 417.

Hab. Gulf of Suez (M'Andrew). B.M.

Astropecten Hemprichii, Müller & Trosch. Syst. Aster. p. 71; Dujard. & Hupé, Echin. p. 419.

Hab. Red Sea (Burton); Gulf of Suez (M'Andrew). B.M.

Genus LUIDIA, Forbes.

Hemicnemus, Müller & Troschel.

Luidia Savignii, Gray, Ann. & Mag. N. H. 1840, vi. p. 183; Müller & Troschel, Syst. Ast. p. 77, 1842; Savigny, Echin. Egypte, t. 3. f. 1; Hupé, p. 432.

Asterias Savignii, Aud. Expl.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Fam. **Cidaridæ**, Gray.

Cidarides, Dujard. & Hupé, p. 468.

Cidaris baculosa, Lamk. A. s. V.; Aud. 111; Savigny, Echin. Egypte, t. 7. f. 1; Michelin, Mag. Zool. 1845, p. 18, t. 4. f. 1–8; Dujard. & Hupé, p. 471; Martens, Wiegm. Arch. 1866, p. 141.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

The spines vary in form according to the age of the specimens. In the young the spines are elongate, slender, fusiform, with the distal end attenuated to a more or less acute tip, and the spines are twice or sometimes even more than twice the length of the diameter of its body.

In the older specimens the spines are nearly cylindrical, scarcely attenuated at the end, which is often truncated; they are rarely longer than the diameter of the body: the spines near the vent have the apex deeply and irregularly grooved; those nearer the mouth have the end truncated and more or less dilated, with a more or less flat or concave end, which is sometimes furnished on the margin with irregular lobes.

The spines on the upper surface of the body are often entirely covered with tufts of *Jania* or a thin crust of *Lepralia*; and some of them have one or more small parasitic oysters with a crenated and plicated margin affixed to them: such parasitic growths were not present on the spines of any of the other *Echini* in the collection. The spines on the underside, especially those nearer the mouth, are clear, and show the spicules on the surface; these vary a little in shape at the end.

A very young specimen, apparently of the same species, is brown, and the spines brown and white-ringed; the spines are quite clear, and covered with longitudinal series of rather large rounded tubercles. The spines vary in shape: they are generally cylindrical and truncated; but a few are fusiform and tapering to a point.

Cidaris ornata (Gray, P. Z. S. 1855, p. 37) is perhaps a variety.

Echinothrix Desorii, Bölsche, Archiv für Naturgesch. 1865, p. 330.

Astropyga Desorii, Agassiz, Ann. Sci. Nat. 1846, p. 345.

Hab. Red Sea.

Diadema Savignii, Michelin, Mag. Zool.; Agassiz, A. R. p. 349; Dujard. & Hupé, Echin. p. 505; Savigny, Echin. Egypte, t. 6; Bölsche, Arch. für Naturg. 1865, p. 227.

Cidarites mamillata, Aud. p. 109.
Jun. *D. Lamarckii*, Agassiz.
Echinothrix calamaris, Peters.
—— *turcarum*, Peters, Bölsche.
Garetia turcarum, Agassiz.
Diadema Dujardinii, Michelin, Mag. Zool. 1845, t. 7.

Var. 1. The spines of the oral surface white.
Var. 2. Spines all pale.

Hab. Red Sea.

See:—*Diadema* (*Echinothrix*) *calamare*, Martens, Wiegm. Arch. 1866, p. 150. *Echinus calamarius*, Pallas, Spic. Zool. x. p. 38, t. 2. f. 4–8; Gmelin, Syst. Nat. p. 3173. *Cidaris calamarius*, Leske, Lamk., Gray; Michelin, Rev. Zool. p. 14, no. 26. *Astropyga calamaria*, Agassiz.

The shell is covered with small black spines. The upper part of the shell has a broad, smooth area, radiating from the anal opening, as in *Astropyga*. The spines are very slender, tubular, and covered externally with whorls of short, regular, closely packed, adpressed spines. The spines near the oral region are slender, subcylindrical, striated, slightly depressed, and clavate at the end.

I have not seen any specimen with such long slender spines as that figured in the great work on Egypt. In all I have seen the spines were thicker compared with their length, and much shorter compared with the diameter of the body.

Temnopleurus toreumaticus, Agassiz; Dujard. & Hupé, p. 514; Gray, P. Z. S. 1855, p. 39.

Cidaris toreumaticus, Klein.
Echinus sculptus, Lamk.

Hab. Red Sea. Subfossil, Isle of Karrah (Dujardin).

Fam. **Echinidæ.**

Echinides, Dujard. & Hupé, Echin. p. 440.

Tripneustes —— ?

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

"Pure red when alive" (M'Andrew). B.M.

Tripneustes —— ?

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

"White when alive" (M'Andrew).

Fam. **Echinometridæ.**

Echinometra lucunter, Gray; Dujard. & Hupé, p. 538.

Echinus lucunter, Linn.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Tubercles very numerous, small.

? *Echinometra heteropora*, Agassiz; Dujard. & Hupé, p. 538.

Hab. Red Sea. Subfossil (Dujardin).

Acrocladia mamillata, Agassiz; Dujard. & Hupé, p. 539.

Cidaris mamillatus, Leske, t. 6, t. 39. f. 1.
Echinus mamillatus, Lamk.
Echinometra mamillata, Blainv., Martens.
Heterocentrotus mamillatus, Brandt.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

The spines vary greatly in shape; they are usually clavate, but more or less three-keeled near the end, which is generally rounded.

The short, broad, top spine in two of the specimens was dark brown; in another paler.

Acrocladia planispina, Martens, Verh. zool.-bot. Ges. in Wien, 1866, p. 381; Zool. Record, 1866, p. 617.

Hab. Red Sea (Martens).

Spines not triangular as in *A. trigonaria*, nor club-shaped as in *A. mamillata*, nor cylindrical as in another Red Sea species, *A. Blainvillei*, but small and pointed, and the corona covered with true spines.

Agassiz notices a small specimen from the Red Sea in the Paris Museum, which he names *A. Blainvillei.*

See Dujardin & Hupé, Echin. p. 540.

I believe, from Mr. M'Andrew's series, that the *A. Blainvillei* is only a variety of *A. mamillata.*

Fam. **Scutellidæ**, Gray; Martens, Wiegm. Arch. 1866, p. 170.

Clypeastroidea, Agassiz & Desor; Dujard. & Hupé, p. 554.

Echinanthus placunarius, Gray, Cat. Echin. B. M. p. 7.

Scutella ambigena, Lamk.
—— *albigena*, Lamk.
—— *placunaria*, Lamk.
Clypeaster placunarius, Lamk.; Dujardin. & Hupé, p. 571; Martens, Wiegm. Arch. 1866, p. 172.

Hab. Red Sea; Gulf of Suez (M'Andrew).

Echinanthus scutiformis, Gray, Cat. Echin. B. M. p. 5.

Clypeaster scutiformis, Lamk.
Laganum scutiforme, Gray, Ann. Phil. 1825; Desor, Syn. p. 329; Dujard. & Hupé, p. 559; E. M. t. 147. f. 3.
Scutella clypeastriformis, Blainv.; Seba, iii. t. 15. f. 23, 24.
Laganum depressum, Lesson, Voy. Uran.; Agassiz, Mon. Scut. p. 110, t. 23. f. 1–7.

Hab. Red Sea; Gulf of Suez (M'Andrew).

Laganum attenuatum?, Gray, Cat. Echin. B. M. p. 10.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Laganum ellipticum, Agassiz, Mon. Scut. t. 23. f. 13–15; Dujard. & Hupé, p. 560.

Laganum attenuatum, Agassiz, Cat. Scut. p. 74; Dujard. & Hupé, p. 560.

Hab. Red Sea.

Echinodiscus truncatus, Gray, Cat. Echin. B. M. p. 20.

Lobophora truncata, Agassiz; Dujard. & Hupé, p. 565.
Scutella bifora, var., Lamk.
—— *biforis*, Blainv.

Hab. Red Sea; Gulf of Suez (M'Andrew).

Echinodiscus maurita, Gray, Cat. Echin. p. 21.

Lobophora bifissa, Agassiz; Dujard. & Hupé, p. 363; Martens, Wiegm. Arch. 1866, p. 174; Savigny, Echin. t. 7. f. 3.
Scutella bifissa, Lamk. E. M. t. 152. f. 1, 2.
Echinus inauritus, Gmelin, p. 3190.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Var. *Lobophora aurita*, Agassiz; Dujard. & Hupé, p. 365.

Scutella bifissa, var., Lamk. E. M. t. 151. f. 5, 6.
Echinoglycus auritus, Vauchel. p. 34; Bleeker.
Echinodiscus inauritus, var., Gray, Cat. Echin. p. 21.

Hab. Red Sea.

Fibularia craniolaris, Lamk.; Dujard. & Hupé, p. 557.

Echinus craniolaris, Gmel. S. N. p. 3193.
Fibularia nucleus, Lamk.
—— *trigona*, Lamk.
—— *lathyrus*, Lamk.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Fam. **Spatangidæ**, Gray, Cat. Echin. B. M. p. 38.

Brissus bicinctus, Val.; Agassiz; Dujard. & Hupé, Echin. p. 608.

Hab. Red Sea (Valenciennes, Mus. Paris).

Lovenia hystrix, Agassiz; Dujard. & Hupé, Echin. p. 606; Gray, Cat. Echin. B. M. p. 45; Savigny, Echin. Egypte, t. 2. f. 3.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Spatangus meridionalis, Risso, Eur. Mérid. v. p. 228; Gray, Cat. Ech. B. M. p. 47; Duj. & Hupé, Ech. p. 608.

Spatangus siculus, Agassiz & Desor.

Hab. Gulf of Suez (M'Andrew). B.M.

Periaster gibberulus, D'Orb.; Dujard. & Hupé, p. 598.

Schizaster gibberulus, Agassiz; Savigny, Echin. Egypte, t. 7. f. 6.

Hab. Red Sea (Savigny).

Fam. **Holothuriadæ.**

Holothuria impatiens, Linn.; Dujard. & Hupé, p. 617; Forsk. Egypt, p. 121, t. 39. f. B=E. M. t. 86. f. 1.

Fistularia impatiens, Lamk.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Savigny figures eleven kinds of this family, viz. five in tab. 8 and six in tab. 9. They are not quoted by Dujardin and Hupé; so I fear that the specimens obtained by the French naturalists and figured by Savigny no longer exist in the

French Museum, like the specimens obtained by Quoy, Gaimard, and other French travellers. I have not had the opportunity or time to examine the Red-Sea species.

Synapta reciprocans, Dujard. & Hupé, p. 615.

Fistularia reciprocans, Forsk. Egypte, p. 121, t. 30. f. 8=E. M. t. 87. f. 7.
Holothuria glutina, Lamk.

Hab. Red Sea (Forskål).

Synapta vittata, Jæger; Dujard. & Hupé, p. 615.

Fistularia vittata, Forsk. Egypte, p. 223, t. 37. f. 26=E. M. t. 87. f. 8, 9.
Holothuria vittata, Lamk.
Tiedemannia vittata, Lamk.

Hab. Red Sea (Forskål).

Alcyonoid corals and sponge from the Gulf of Suez, collected by R. M'Andrew, Esq., in 1868:—

CORALS.

Sarcophyton ——, n. sp.

On shells.

Ammothea virescens, Savigny, Pol. Egypte, t. 2. f. 6.

Nephthya Savignii, Ehrenb.

Xenea umbellata, Ehrenb.

Anthelia glauca, Ehrenb.; Savigny, t. 1. f. 7.

Anthelia grandis, n. sp.

Alcyonium aurum, n. sp.

This is not *Amocella*; the coral is not fleshy, but crustaceous externally, and with subcylindrical branches.

SPONGE.

Genus GRAYELLA, Carter, Ann. & Mag. N. H. 1869, iv. p. 190.

Sponge massive, expanded or subglobular, attached by an expanded base; outer surface covered with a smooth fleshy skin, with numerous, regular, equal-sized, flat-topped, low tubercles. Sponge fleshy, with spicules siliceous, fusiform, elongate, of one form.

Grayella cyathophora, Carter.

Hab. Red Sea; Gulf of Suez (M'Andrew). B.M.

Corals collected in the Red Sea by R. M'Andrew, Esq., in 1869, and given to the British Museum by Mr. W. S. Kent:—

Heterocyathus cochlea.
Stylophora pistillata.
—— subseriata.
Eusmilia fastigiata.
Lithophyllia lacera.
Mussa corymbosa.
Trachypora Geoffroyii.
Favia cavernosa.
Solenastræa Hemprichiana.
Fungia patella.
Cycloseris cyclolites.
Madrepora corymbosa.
Turbinaria cinerascens.
Alveopora dædalea.
Porites conglomerata.
Seriatopora lineata.
Tubipora musica.

XVII.—*Description of a new Genus and Species of Heterocerous Lepidoptera.* By ARTHUR GARDINER BUTLER, F.L.S., F.Z.S., &c.

[Plate VIII.]

THE following remarkable species is in the collection of the Rev. T. Cornthwaite. It presents the most wonderful modification of the Lepidopterous scale that I have ever seen; and I am much indebted to its possessor for the pleasure of describing and figuring it.

Group BOMBYCITES.

Family **Notodontidæ.**

TARSOLEPIS (ταρσὸς, λεπὶς), gen. nov.

Gen. alis magnis, anticis elongatis, costa producta; antennis plus quam bis triente pectinatis; corpore robusto, abdomine elongato, squamis valde elongatis remiformibus analibus; valvulis dense pilosis; subtus cristis ad basin abdominis elongatis, arcuatis, coccineis, aliisque brevioribus, ochraceis. Generis typus *T. remicauda.*

Tarsolepis remicauda, sp. n. Pl. VIII.

Wings above brownish grey; the costæ and bases pale ochreous: primaries with central area chestnut-brown, interrupted between the nervures by double parallel lines uniting at their extremities and bounded externally by an irregular whitish line; two large subtriangular silver patches placed obliquely on central area; outer margin sinuated and bordered by a tricoloured band of black, ochreous, and chestnut; a very indistinct, blackish, lunulate line between margin and central area: secondaries paler than primaries, with dusky spot at end of cell; the margin externally chestnut-brown, internally pale ochraceous; fringe white: body above, with head, palpi, and antennæ, reddish brown, whitish in parts; collar very broad, silver-grey, with a transverse interrupted blackish stripe

med this minute but beautiful hydroid after t Wortley, in whose tanks it was first found. It the glass sides of the tank, sending out long ots, whence the polypites rise at intervals. ntly appeared suddenly in my tanks, and, I fancy, mon, though liable to be overlooked through its

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Muscular Anatomy of the Koala (Phascolarctos . By ALEXANDER MACALISTER, M.B., Professor gy, University of Dublin.

female Koala was procured from Mr. Gerrard by ughton for the Anatomical Museum of the Dublin y; and as it was in splendid condition for dissection, enabled to examine its muscular system thoroughly. ts anatomical arrangements it is by far the most form among the Marsupials, I have compiled the g list of its peculiarities, from which it will be d that the myology of this animal is full of interesting s.

specimen was a salted one; but its muscles were lingly well preserved and easily dissected. She mea- 26 inches in length; and throughout there was a ed disproportion in the development of the two sides, the ide muscles being very much larger and stronger than right. There was an exceedingly strong *panniculus osus*, which sprang from the outside of the arm, and the s of which passed backwards in an arcuate manner to the gument of the sides; and forward, forming a very thick *tysma myoides* in the neck; this muscle had a thick rounded terior border, and terminated by being inserted into the in along the ramus of the mandible; and, stretching even ove this limit, the facial fibres formed an even sheet over e front of the *masseter* and the facial artery to terminate in he middle line of the lower lip, the margin of the mouth, the ala of the nose, and the lower margin of the orbicular muscle of the eyelids.

The *platysma* on the hinder part of the body displayed nothing of importance; its femoral attachment was weak.

The facial muscles were unusually strong, the *orbicularis palpebrarum* being a simple thick ring, composed of several thick fascicles; the *occipitalis* arises from the occipital protuberance, and passes radiating forwards; the *frontalis*, quite separate, arises from the mesial line of the scalp, and runs downwards to the inner half of the upper edge of the *orbicularis palpebrarum*, extending into the origin of the *levator labii superioris*.

The large auricle had a powerful arrangement of muscles for its motions, having three series of transverse intrinsic fibres on the back of the concha, and a strong bilaminar *retrahens aurem*, which came from the occipital protuberance, external and attached to the *occipitalis*, and was inserted by the superficial layer of fibres into the back of the auricle; the deep layer bifurcated into two muscular bundles—an upper to the upper and anterior part of the auricle, and a lower to the inferior part of the same cartilage.

The *attollens aurem* was thin and wide; and the *attrahens* was a very strong wide slip, inseparable from the *platysma*; a second special *attrahens* existed in the form of a flat fleshy slip from the anterior half inch of the temporal crest behind the postorbital process, which ran downwards and backwards over the temporal fascia and zygomatic arch to the inferior margin of the helix: the lowest third of this muscle is tendinous. The other facial muscles were a single-headed *levator labii superioris alæque nasi*, a *depressor labii inferioris*, and *levator menti*. I found no muscles attached to the angle of the mouth other than the wide continued sheet of the *platysma*. The *orbicularis oris* was strong, but the *buccinator* was very feeble. A *depressor labii superioris* from the upper alveolar arch completes the catalogue. There was no zygomatic or buccal salivary gland.

The masticatory muscles were arranged as in all the Marsupials, and equalled the pectorals in weight (*masseteres* + *temporales* = 1·4 oz.).

The *external pterygoid* is an exceedingly small rudiment, crossing and inseparable from the internal.

The *sterno-mastoid* was four times the size of the *cleido-mastoid*, and was inserted fleshy into the outer side of the elongated paroccipital process. The latter had a tendinous insertion, and was attached more internally to the same process; its origin was by a fine flat fleshy band from the inner sixth of the clavicle.

The *omo-hyoid* arose far back from the præscapula near its superior angle; it had no tendinous inscription, and was inserted into the hyoid body and into a tendinous line in the angle between the *digastric* and *sterno-hyoid* muscles, to both of which it is connected. The posterior belly of the *digastric* is exceedingly small and short, and arises from the front of the paroccipital process; it ends in a tendinous inscription which gives partial origin to the anterior belly; but this latter part is treble the size of the posterior, gaining an additional origin from the tendinous line in which the *omo-* and *sterno-hyoid* muscles terminate. The tendinous inscription is very short and oblique.

Sterno-hyoid is monogastric, and has a strong origin from the back of the clavicle as well as from the second and third pieces of the sternum. *Sterno-thyroid* is much shorter and more narrow, and has likewise no inscription. *Mylo-hyoid* has very short fibres, and extends down for a very considerable distance, overlying the very long slender *genio-hyoidei.* A transverse band of muscle, like an aberrant slip of the *mylo-hyoid*, crossed beneath the *genio-hyoidei* and superficial to the *genio-hyo-glossi*; this is on each side attached to the mucous membrane. The styloid group of muscles formed a single sheet, the hinder fibres of which passed to the pharynx, the middle to the cerato-hyal under the stylo-hyoid ligament; the anterior passed to the side of the tongue. *Genio-hyo-glossi*, the palatine muscles, and *linguales* are very normal.

The *trapezius* is an indivisible sheet extending from the inner third of the occiput to the seventh dorsal spine; its insertion is into the acromion and spine of the scapula; and, partly crossing the former, some of its fibres are inserted into the surface of the tendinous fibres of origin of the *deltoid.* The *latissimus dorsi* arose from the fourth to the tenth dorsal spines, and, by the lumbar fascia, from the four spines below these; it had no costal origin.

The *trachelo-acromial* (*omo-atlantic*) occupied by its insertion one half the length of the spine of the scapula, and was much thicker than usual. The *rhomboid* muscle is single and large, half the size of the *trapezius*; it occupies one half the occipital curved line, the middle line of the nucha, and the three upper dorsal spines. *Serratus magnus* was a single muscle consisting of thirteen slips, six cervical and seven costal, whose insertion was indivisible; *serratus posticus superior* extends in its insertion from the second to the eighth rib; *serratus inferior*, quite continuous with it, only distinguishable by the upward direction of its fibres, was attached to the ninth, tenth, and eleventh ribs. *Splenius* arose from the three upper dorsal and five lower cervical spines, and was attached to the occiput and three upper cervical transverse processes. *Trachelo-mastoid* is not digastric, and stretches from the five lower cervical transverse processes to the occipital bone. The other spinal muscles were invariable.

The *great pectoral* is large, having the usual attachments; beneath it there are the following three muscles:—*pectoralis minor*, from the cartilages of the third and fourth ribs to the shoulder-capsule; *pectoralis quartus*, from the cartilages of the lowest four ribs to the shoulder-capsule; and a third pectoral (*pectoralis minimus* of Wenzel Grube), from the manubrium sterni and cartilage of the first rib to the shoulder-capsule. The *subclavius*, under a strong costo-coracoid membrane, stretches to the posterior margin of the outer third of the clavicle.

The *deltoid* is a single muscle, composed of its three parts united inseparably, and sending an extensive offshoot at its insertion, which is continuous into the origin of the *supinator longus*. The capsular muscles are developed in the following proportions:—*deltoid*=1, *supraspinatus*=1·11, *infraspinatus* =1·69, *teres minor* (exceedingly thin, with a marginal tendinous origin for one fifth the axillary costa of the scapula and an unusually wide fleshy insertion) =·08, *subscapularis* =2, *teres major*=1.

The *biceps* is, as usual in Marsupials, composed of a partially united *gleno-ulnar* and a *coraco-radial* muscle; the latter receives a large fascicle from the former; the *brachialis anticus* is long; the *triceps externus* and *internus* are united; and the muscles of this region have to each other the following proportions:—*biceps coracoidalis* =1, *glenoidalis* = 0·68, *brachialis* =0·8, *triceps longus*=2, *triceps externus* and *internus*=2·6, *dorsi epitrochlearis* (which is inserted into the inner condyle and olecranon) = 0·44. There are two *anconæi*, external and internal.

The *pronator* and *supinator* muscles are well-developed. The *round pronator* has but one head; and the *quadrate pronator* occupies the lower sixth of the forearm. *Supinator longus*, besides an origin from the *deltoid*, is attached to the lower half of the humerus; and its tendon, passing under the tendon of the *abductor major pollicis* and lying on the wrist synovial membrane, was inserted into the scaphoid bone. The *supinator brevis* occupies two fifths of the radius. These muscles are developed in the following proportions:—*Pronatores* : *supinatores* :: 1 : 4.

The other muscles in the forearm are well marked. The radial and ulnar flexors of the carpus and the *palmaris longus* are simple and normal; the *flexor sublimis digitorum* arises from the front of the deep flexor, and is exceedingly feeble; its tendon for the fourth finger is the strongest. The deep flexor consists of four heads—one condyloid, one olecranal, one radial, and one ulnar; five tendons spring from this; but the polliceal tendon is not from the radial border of the common tendon, but springs from the front of the tendon inside the edge, as is sometimes the case in the Quadrumana.

The *extensores carpi radiales* are as usual, and are inserted, not into the carpal ends, but into the middle of the shaft of their respective metacarpal bones. The *extensor secundus digitorum* was attached to the fourth and fifth fingers. The other extensors of the fingers, ulnar carpal extensor and *extensor secundi internodii pollicis*, are as usual.

The *abductor pollicis major* has a radio-interosseal origin and a double tendon of insertion into the trapezium and first metacarpal. The left *indicator* sent a filmy slip to the pollex. There is a separate *extensor medii digiti*, with an ulnar origin. The proportions of these muscles are as follows:—flexors of the wrist (*f. c. r.*, *p. l.*, *f. c. ul.*) : extensors of wrist (*e. c. r. l.* & *b.*, *e. c. ul.*) :: 0·36 : 0·75; flexors of fingers (*f. d. s.*, *f. d. p.*) : extensors (*e. d. c.*, *e. d. s.*, *e. oss. m. p.*, *e. s. int. p.*, *e. i.*, *e. m. d.*) :: 0·21 : 0·36.

The hand-muscles are as follows:—For the pollex, an *abductor brevis*, a single-headed *flexor*, an *opponens*, and an *adductor* (from the third metacarpal). For the little finger there are the following muscles:—*abductor*, *opponens*, and *flexor* muscles. The dorsal interossei are (1) a two-headed *abductor indicis*, (2) a two-headed *abductor medii*, (3) a bicipital *abductor medii*, (4) an *abductor quarti digiti*; the palmar interossei are (1) an *adductor indicis* from the second metacarpal under the *adductor pollicis*, (2) a common *adductor* of the third and fourth digits.

There is no *scalenus anticus*; the *medius* is attached to the first rib and to the fourth to the seventh vertebræ; the *posticus* from the fifth transverse process to the third rib. *Longus colli* consists of three parts—one from the bodies of the upper five dorsal vertebræ to the cervical transverse processes, a second part from the transverse processes of the fourth to the seventh cervical vertebræ extending to the cervical bodies (second to fifth), and a third from the same origin to the occiput.

The *external oblique* is attached to the ribs from the third to the eleventh; the *internal oblique* and *transversalis* are with very great difficulty separable. The *rectus abdominis* has eight lineæ transversæ intersecting it, and is attached to the xiphisternum and to the cartilages of the second to the sixth ribs. *Pyramidalis* is very wide, covers the entire of the *rectus*, and is attached to the linea alba. The lumbar vertebræ, besides the ordinary *quadratus lumborum* (with its three usual component parts), have attached to them anterior *intertransversales*, most of whose fibres skip two vertebræ. The *psoas parvus* is equal to the *psoas magnus* and 0·37 times the size of the combined *psoas magnus* and *iliacus*, whose elements are imperfectly separable; the latter part of this mass is bipartite, the portion most closely united to the *psoas magnus* being separate from a part of the muscle arising from the anterior superior iliac spine.

The *sartorius* is wide, and inserted into the inner side of the patella, as well as into the knee-capsule and tibia. The *pectineus* is double at its insertion, but has a single origin. The *adductor longus* is inserted posterior and superior to the pectineus, and is very small, but attached to the marsupial bone, as Prof. Owen observes. The rest of the adductor mass exhibits a faint division into the three usual elements, the condyloid and the anterior and posterior strata of *magnus*. *Quadratus femoris* has a narrow ischiatic and a very wide femoral attachment occupying the upper sixth of the femur; it is, however, with great difficulty separated from the *adductor magnus*.

The *gluteus maximus* is bilaminar, the sacral part overlapping the coccygeal; its insertion is into the whole length of the linea aspera. The *gluteus medius* is bilaminar, and the *pyriformis* is perfectly separate, arising from the front surface of three vertebræ; over this muscle passes the sciatic nerve. *Gluteus minimus* arises from the acetabular margin and from the surface behind it, as well as from the anterior margin of the ilium. I could separate no *tensor vaginæ femoris*.

Rectus femoris had but a single head; and the other elements in the extensor mass formed but one continuous belly, in which the *vastus externus* portion is by far the largest factor. The hamstrings are the usual three; and none of them exhibits a trace of a tendinous inscription. *Biceps* has a narrow tendon of origin $1''\cdot25$ in length from the sacrum, which is tied down to and parallel with the great sciatic ligament; the insertion is wide and fleshy. The proportionate development of these muscles is as follows:—*rectus* = 1, *biceps* = 1, *semimembranosus* = 1·45, *semitendinosus* = 0·80, rest of the *quadriceps extensor* = 3·58. Thus the flexors : extensors :: 1·87 oz. : 2·11 oz. (I have included the *gracilis* with the flexors; it has a pubic origin and a slender insertion, and equals the *semitendinosus* in weight.)

The *popliteus* muscle arises from the fibula alone, and is inserted into the tibia close to the *tibialis posticus*.

The outer head of the *gastrocnemius* has a sesamoid bone in its tendon of origin; the inner head, which is only half its size, has no such bone. *Plantaris* arises from the sesamoid bone, inseparable from the outer head, and does not become distinguishable until about the lower third of the leg; its tendon is inserted into the fascia of the foot on the inner side of the heel. We could not separate any *solæus* from the *gastrocnemius externus*.

The common flexor of the toes had an origin mainly fibular, and sent off five tendons, those of the second and third toes being closely joined for the longest portion of their extent.

Tibialis posticus is double:—a larger muscle, placed rather more superficially, and inserted anteriorly into the sesamoid at the base of the hallux; a smaller, deeper muscle, inserted into the entocuneiform and second and third metatarsals.

The perforated flexor of the toes was a very remarkable muscle; it lay, not in the foot as usual, but on the back of the leg, arising from the surface of the *flexor profundus* for the lower half of the leg, exactly like its homotype the *flexor sublimis* in the forearm; its fleshy portion does not extend below the ankle; but its tendons pass to the second, third, fourth, and fifth toes. There is no *flexor accessorius* in the foot; but a muscle, evidently similar to this in nature, passes from the calcaneum to the sesamoid at the base of the hallux.

There is a long *peronæus* which arises from the upper half of the fibula and from the sesamoid bone of the *gastrocnemius externus*; this is inserted as usual. *Peronæus brevis* is also normal, and quite separate from the *peronæus quinti*, below which it arises. There is also a *peronæus quarti metatarsi* in front of the *quinti*, perfectly separate from it and placed behind the malleolus.

Tibialis anticus and *extensor hallucis* are normal. The *extensor digitorum* sends off four tendons; but those for the second and third digits are connected until very close to their insertion.

On the back of the leg there is a large *pronator quadratus* like that in the leg of other Marsupials and the crocodile; this occupied more than half the length.

The foot-muscles are the following:—For the hallux there is an *abductor*, a bicipital *flexor brevis*, an *opponens* (from the inner cuneiform to the metatarsal), and an *adductor* (from the second metatarsal to the hallux); there is also an "*interosseus primus volaris*," like Henle's interosseous in the manus. For the little finger there is an *abductor* proper and a separate *abductor ossis metatarsi minimi digiti* (Flower). There is no *lumbricalis* for the second digit; that for the third comes from the tendon for the third digit alone; that for the fourth comes from the third and fourth tendons; and that for the fifth comes from the fourth tendon.

The *interossei* are arranged as follows:—The dorsal are: (1) *abductor indicis*, bicipital; (2) *abductor medii*, bicipital; (3) *abductor quarti*, also two-headed; (4) *abductor quarti*, with only one head from the fourth metatarsal. The palmar are: (1) *adductor hallucis*, as before mentioned; (2) *adductor indicis*; (3) *adductor* (?) *medii*, from the second metatarsal to the fibular side of the third, whose metatarsal it crosses; (4) *adductor minimi digiti*. There is also a very small *opponens minimi digiti* inserted into the metatarsal of the fifth toe.

Prof. Owen has said that among the Marsupials "the Koala has the best claim to typical preeminence" (Todd's Cyclop. vol. iii. p. 329); and certainly from the foregoing account it will be seen that this animal presents, in its muscular system, a greater number of structural divergences from the general placental type than, perhaps, any other Didelphian.

XX.—*On a new Genus of Hexaradiate and other Sponges discovered in the Philippine Islands by* Dr. A. B. Meyer.

By Dr. J. E. Gray, F.R.S. &c.

Dr. Adolf Bernhard Meyer has brought with him some beautiful species of hexaradiate sponges, which he obtained at Talisay on Cebu, in March 1872, and they are now in the collection of the British Museum.

The two principal sponges discovered by Dr. Meyer would form two very distinct families according to the classification published in the Ann. & Mag. Nat. Hist. 1872, June, p. 442. They both belong to the order Coralliospongia. Before I proceed to define them I may remark that the order may be divided into three groups:—

I. The normal Coralliosponges have elongate subulate rays to the hexaradiate spicules, which are generally smooth, but one or more of them may be covered with spines or lobes directed towards the tip. This group contains the first ten families in the paper above referred to. The genus *Crateromorpha* here described appears to belong to it.

II. This group, which may be considered the abnormal form of the order, has the hexaradiate spines with short uniform rays of equal length, each ending in a number of reflexed lobes, and forming in their completely developed state a cube.

It will contain two families, and may be thus divided:—

A. *Sponge sessile, attached.*

Fam. 1. **Carteriadæ.**

B. *Sponge free, attached to the bottom of the sea by tufts of elongate anchoring fibres.*

Fam. 2. **Meyerinidæ.**

Sponge elongate, tubular, covered with a cobweb-like netted coat, with a circle of tufts of anchoring fibres at the base, which extend more than halfway through the length of the body, and then, by repetition of a shorter kind, are continued on to the apex, where they also form a circle of tufts round the margin of the apical aperture.

Genus 1. *Meyerina.*

III. This group, which is equally abnormal, has the hexaradiate spicules with very short cubic rays. The genus *Axos* alone belongs to this group.

I have described this sponge under the name of "*Meyerella claviformis*," Ann. & Mag. Nat. Hist. for July 1872, p. 76; but as I am told that the generic name of "*Meyerella*" has been used for a genus of small Lepidoptera, I propose to alter this name to *Meyerina claviformis.*

Dr. Meyer brought a second specimen of this beautiful sponge. The club is rather smaller compared with the size of the stem, which is considerably thicker than in the other specimen. The elongate transparent spicules by which the sponge is anchored to the bottom are placed in very numerous cylindrical fascicles rather close together in a circle on the edge of the truncated circular base of the stem of the sponge. These cylindrical rope-like fascicles may be seen to extend in the way above mentioned throughout the whole length of the body, terminating in small tufts of naked spicules round the apex of the club; while the whole surface appears covered with hexaradiate spicules, like those of *Holtenia*—that is to say, with the external end of the axis abortive.

Mr. Carter has kindly examined this sponge microscopically, and in a note observes:—"It is a true *Carteria*, so nearly allied in the form of the spicules that but for its general form it might be a second species of the genus. The net-like structure over this sponge is just that of *Carteria* in spicular composition, as already mentioned."

The discovery of a second species of the genus, or rather family *Carteriadæ*, decidedly shows that the sponge that is found parasitic on the *Hyalonema* cannot be a part of that genus, as Dr. Bowerbank, Dr. Wyville Thomson, and others have supposed; for no one can believe for a minute that the free claviform Philippine *Carteria* is any part of a *Hyalonema*, which it ought to be if the attached Japanese *Carteria* is only a state of that genus, or that one species of the genus is only a state of another most distinct genus, and the other species a distinct genus by itself; for surely *Meyerina claviformis* is not a state of *Hyalonema*! Indeed Mr. Carter observes that "*Meyerina* is more nearly allied to *Holtenia* than *Carteria*; but they are both allied in their spicules and differ chiefly in their general structure and form." I am glad to state that Mr. Carter has undertaken to examine this sponge more in detail.

The other sponge is of the shape and size of a large goblet, with a cylindrical stem nearly as long as the cup, which I propose to describe as

CRATEROMORPHA.

Sponge attached to marine bodies, goblet-shaped.

Body hollow, vasiform, with a circular mouth, swollen at the bottom, placed at the top of the stem, and of very different structure from it, the line of demarcation being distinctly marked. Vase rather dilated and thick at the bottom, very thin towards the edge, which is terminated by a very thin membrane-like margin. The outer surface of the vase pierced with cylindrical cavities, and the whole surface covered with a minute network formed of the four rays of hexaradiate spines, which are so placed as to form square meshes. The internal cavity large, reaching nearly to the bottom of the vase, and furnished at the base with very large irregularly shaped oscules, which become smaller, more regular, and oblong-lanceolate about the middle of the walls, and circular in the upper part, gradually diminishing in size as they approach the margin of the cavity, where they are smallest.

Stem thick, cylindrical, with numerous parallel, similar, longitudinal, cylindrical tubular spaces in a felt of spicules; covered externally with a layer of short robust ones arranged longitudinally, and on this, again, the minute network with square meshes, like that on the club, finally ending below in a multitude of spiculiferous filaments extending some way into the mass of sandy mud at its base.

Crateromorpha Meyeri.

Hab. Philippine Islands, Talisay, on Cebu, March 1872 (Dr. A. B. Meyer).

This sponge is like a large goblet, with the body about 3½ inches long, and a thick stem of nearly the same length, which is attached to a mass of hard mud. The stem is pale reddish brown, and the body greenish white; in its dry state, and most probably bleached.

The cruciform central rays of the hexaradiate spicules are short and placed regularly perpendicularly—that is to say, parallel to the longitudinal axis of the body—and the others horizontally, or transversely with regard to the imaginary axis of the sponge. The rays of each spicule are free from those of its neighbour, but overlap each other to their full extent, and so form a regular network of square meshes, as in the genus

Farrea, where the spicules are united by their rays but imbedded in glassy fibre; hence, as Mr. Carter observes, Dr. Bowerbank's mistake of calling it "fistulous siliceous fibre" (B. S.); whereas in the genus *Holtenia* and allied genera the cruciform rays of the hexaradiate spicules are placed obliquely with regard to the axis, forming a network of rhombic meshes.

This sponge evidently belongs to the first group of the Coralliospongia, and the first section of them, as defined in my paper above referred to (p. 450), and will form a family distinct from those there defined, which may be thus characterized:—

Fam. **Crateromorphidæ.**

Sponge cup-shaped, attached by an elongated pedicel, formed of numerous short spicules. Body of sponge covered externally with hexaradiate spicules, the outer ray of which is aborted, placed in longitudinal and transverse lines, making a square mesh; hollow, with large oscules, which diminish in size as they reach the margin of the cup. Stem formed of numerous cylindrical tubes, situated in a spiculous felt; ending in a bunch of filaments sunk in the mud.

Rossella philippensis.

Dr. Meyer also brought from Cebu a sponge the size of a moderately large walnut (that is, about 1¼ inch long), regular, oblong, smooth, thick, spongy, truncated at the top, with large circular apertures, and with a large deep cavity occupying nearly the whole of the body of the sponge. The hinder half of the sponge has sundry distant cylindrical tufts of elongated siliceous fibres spreading out from the sponge and then directed backwards.

This is very like the *Tetilla polyura* of Schmidt (Atlantic Sponge-Fauna, t. vi. f. 8), the type of my genus *Lophurella*; but the Philippine sponge is oblong, longer than broad, smooth on the external surface, and truncated above, with a large mouth, in fact like a round-based tumbler.

If this is the young state of another sponge of a different form, which is possible, it is a giant of its kind. The *Tetilla polyura* of Schmidt is only ⅓ inch long; and the young form of *Tethya antarctica* described by Mr. Carter is much smaller, in fact microscopic; whereas this is more than an inch long and comparatively broad, and resembles the goblet of *Crateromorpha Meyeri*. It is not the young of that sponge, as Mr. Carter shows that the spicules are markedly different; and we have no other Philippine sponge of which it could be the young. Mr. Carter has kindly sent me the following account of his examination of the sponge:—

"This is a *Rossella*, as you will see directly, not *R. antarctica*, simply because the arms of the surface or body in *R. antarctica* are spined; in the Philippine one they are smooth.

"Dr. Wyville Thomson sent me a woodcut of this sponge, noticing its resemblance to Schmidt's *Tetilla polyura.* I wrote back and said it was allied to *Rossella antarctica* and not a *Tethya* at all, for all its spicules, of which there are only two kinds apparent in the figure, are, or should be, *four*-armed.

"No *Tethya* has more than three-armed spicules; but his artist had put in three-armed at the end of the tailed ones. Now I see how the artist has overlooked this important character, just as Schmidt states, at the end of his preface to his Adriatic sponges, 'an artist by profession fails here.'

"There is no such spicule, *four-armed* recurved, in any other sponge. Was I wrong in stating this as the peculiarity of *Rossella*? Have we not now found out a Philippine one by it?

"Has not Thomson's *artist*, because he did not know the value of this fourth arm in the tailed spicules, omitted to put in more than three, although he has put in four in the body-spicules? And do we not here see the disadvantage under which a professed artist labours, as Schmidt has stated?

"I find the Philippine *Rossella* has been put into a bottle with the two other species that you sent down in the box, or at least with the goblet-sponge and the *Euplectella*[*], because it contains spicules of the latter. When the heads of spicules with recurved spines get into other sponges they break off and remain there, because being barbed like an arrow they easily go in, but never come out again; and you can always tell that they do not belong to the species, because they have their heads where their tails ought to be. No spicule has a head like this *in* the sponge: it is always at the extremity of the long spicule, of course. Hence it was that I found so many of the four-armed headed spicules stuck into *Tethya antarctica*, and was thus able to make out the antarctic deep-sea genus *Rossella*.

"There are several of the spicules of the goblet-shaped sponge [*Crateromorpha*] in the surface of the Philippine *Rossella*, especially the minute spicules, somewhat like in structure though not in form to those of *Euplectella*."

Mr. Carter, in a subsequent note, states that the *minute* spicules in *Crateromorpha* and *Rossella* are very much alike, and that they both contain crucial-headed ones which are almost undistinguishable from each other.

He also adds that Dr. W. Thomson has sent him the specimen of *Rossella* above alluded to, and that it turns out to be a third species of that genus, being widely different from the antarctic and Philippine ones.

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[*] [It was contained in the same bottle of spirits as *Euplectella*.—J. E. G.]

Euplectella aspergillum.

Dr. A. B. Meyer has brought home, and placed in the British Museum, two specimens of this sponge in spirits from the Philippines, which are entirely covered with a thick coat of sarcode like the bark on a *Gorgonia*, but softer, so that the siliceous fibres are entirely hidden from view. No one would suspect that this sponge had such a beautiful lace-like structure, but simply a netted or pierced tube, with irregular, circular, thicker hoops. The flesh or sarcode is of a dark brown colour, but most likely is coloured by the action of the spirit.

Esperiadæ.—Along with these sponges were sent some fragments of a sponge, according to Mr. Carter's examination, "nearly allied to *Halichondria incrustans*, with three kinds of spicules:—1, large, subulate, smooth; 2, bihamate; 3, equianchorate, larger than the bihamate."

Mr. Carter's microscopical examination of *Meyerina claviformis* and *Crateromorpha Meyeri* will be found at pp. 110–118 of this Number of the 'Annals.'

XXI.—*On* Codiophyllum, *a new Genus of Unicellular Green Algæ from Port Natal.* By Dr. J. E. GRAY, F.R.S. &c.

[Plate IX.]

AMONG a large collection of corals and corallines from Port Natal, sent by Colonel Bolton, I observed some specimens of a green spongy alga of a thick cloth-like texture, more or less of a wedge-shape, and borne on a solid, cylindrical stem, which is branched at the bottom, and may be a distinct Rhodosperm Alga on which it is parasitic. This stem pierces and supports the broad, expanded frond, and is branched so that the branches support the different parts of the expansion. When the felt-like cloth is carefully examined, it is found to consist of a very fine network of fine cylindrical tubular fibre, which inosculates in every direction, leaving a minute mesh. When looked at in a mass, the mesh seems to be arranged in very obscure circles concentric to the outer margin, indicating the lines of growth, the mesh of the outer edge being incomplete. The stem is tough and fleshy when soaked in water, but becomes cartilaginous when dry; in the younger specimens it is tortuous and slightly branched, each branch ending in a triangular, wedge-shaped frond, with the stem extending a slight distance from its base; the stem is thick and gradually tapers as it extends in length, and is affixed to a rock by a rather extended base. The older fronds become more or less semicircular, with one or two slight lobes on the circumference, and the stem becomes divided at the base of the frond into several branches, which spread out in a palmated manner and thus support the different parts of the frond, which rarely throws out a rounded lobe of a similar structure from its surface.

The stem when wet is flesh-coloured, becoming dark brown or blackish when dry; the frond is green, like the rest of the chlorosperm Algæ.

This plant evidently forms a new family; and I do not know to what existing group of the green Algæ to refer it. The filaments of which the felted net is composed are cylindrical, all of the same size, and in external appearance like the fibre of *Cladophora*; but they appear to be entirely destitute of articulations, and they are very unlike the continuous fibre of the *Oscillatoria* or *Calothrix*, and they seem to have most alliance with *Bryopsis*.

This plant, when roughly dried with other seaweeds as it comes out of the sea (and I have little doubt it is so when it is growing), has a matted green frond which is thicker and more opaque in the older and more developed specimens, when it looks like a piece of felted cloth just showing the internal stems through some parts of it; but when it is washed in fresh water and dried between blotting-paper with just sufficient pressure to prevent its curling, the frond loses a great part of its thickness, becomes nearly transparent, shows the details of the network and the internal part of the stem through the substance, very unlike the living state of the plant.

The genus may be thus defined:—

CODIOPHYLLUM.

The frond expanded, formed of uniform, minute network, matted together so as to form a cloth, and consisting of uniform cylindrical tubular fibres supported or parasitic on a cartilaginous solid stem, which pierces the base of the frond and is affixed to the rocks by an expanded base.

Codiophyllum natalense. Pl. IX.

Stem branched, tapering, ending in a triangular wedge-shaped frond, which becomes more or less semicircular, and sometimes furnished with one or more lobes on the surface.

Hab. Coast of Natal.

EXPLANATION OF PLATE IX.

Fig. 1. The adult frond.
Fig. 2. The worn stems of an adult frond; part of the network still remaining.
Fig. 3. A young specimen with root dried after being soaked in fresh water.
Fig. 4. Part of the frond magnified, showing the imperfect meshes in process of formation on the margin.

XXII.—*Answer to Dr. Bowerbank's "Observations on Mr. Carter's paper &c." in the last Number of the 'Annals.'*

By H. J. Carter, F.R.S. &c.

In reply to Dr. Bowerbank's criticisms on my paper "On two new Sponges from the Antarctic Sea &c.," in the 'Annals' of last June, I can only state that I shall be quite satisfied with the verdict that a perusal of our respective papers may give. I employ no artist, make my own drawings, write my own descriptions to the best of my ability, and with nothing to compensate me but the hope that I am communicating the truth, and, in many instances, saving future students from losing time in labouring to understand that which too frequently is imaginary, misconceived, or utterly unintelligible.

Truly it has been said, that "of all extravagance, waste of time is the greatest;" and what is this but a grievous waste entailed upon posterity (if his works ever reach it) of an ignorant or unscrupulous author.

In criticising Dr. Bowerbank's publications I am not criticising Dr. Bowerbank (personally we should not know each other in the street), but simply, as I have before stated, endeavouring to save time for those who may come after us in similar inquiries.

Controversial disputes afford very little interest to any but the parties immediately concerned, and therefore ought not to be allowed to occupy the pages of a valuable scientific journal.

Dr. Bowerbank's and my own descriptions are now before the public; and a practical examination of them concerns the public and posterity much more than it will ever concern us.

I have not time to make finished drawings, but my sketches, I have no doubt, will serve, at least diagrammatically, with my descriptions to convey the meaning I intend to an intelligent naturalist.

Besides, however "talented and accurate a microscopical artist" may be, Dr. Bowerbank will hardly deny, I should think, what Dr. Schmidt states on this subject at the end of the preface to his work on the Adriatic Sponges, viz.:—"Ein Maler von Profession würde die Charaktere vieler Species kaum haben ausdrücken können, &c."

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

May 16, 1872.—Francis Galton, M.A., Vice-President, in the Chair.

"Remarks on the sense of Sight in Birds, accompanied by a description of the Eye, and particularly of the Ciliary Muscle, in three species of the order *Rapaces*." By Robert James Lee, M.A., M.D.

It is proposed in this communication to describe certain peculiarities in the eye of the bird as compared with the eyes of other Vertebrata, and, further, to examine to what extent those peculiarities enable us to explain the remarkable powers of sight with which all species of birds are more or less highly endowed.

Those who study the habits and modes of existence of the lower animals, find great interest in applying to various phenomena connected with them the results of anatomical investigation, and in endeavouring to discover such causes, or means adequate to produce such effects, as to render the supposition of the existence of an indefinite property like instinct very frequently unnecessary.

This method it is my desire to apply in the explanation of those high and distant flights which are performed by certain species of birds in search of food or in their migrations to different localities.

For us it is difficult to form a clear conception of the power of sight possessed by birds if we only use our own faculties in this respect as the standard of comparison; by which I mean to imply that the mind must be prepared for the consideration of the phenomena referred to by observing in detail numerous important differences in the structure of the eye, which combine to facilitate a conception of ideas otherwise beyond the reasonable limits to which even imagination might extend.

This field of inquiry will long engage the attention of the naturalist and anatomist; indeed it may be said to be inexhaustible; and I feel considerable hesitation in offering a contribution insignificantly small to the elucidation of a subject of such magnitude.

We may acquire some idea of the sight of the bird by comparing the dimensions of the eye with those of the brain or the optic lobes; and by arranging the measurements thus obtained, and referring them to some fixed standard, we may estimate the relative and individual powers of vision enjoyed by different species. In illustration of this we have an instance, in the case of one of the birds which I propose to describe minutely in this communication, in which the eye is actually considerably larger than in the human species; and we have a still more striking example, considering the size of the bird, in the *Goura coronata*.

Again, if we regard the eye as an optical instrument, we may estimate its efficiency by examining the internal structures on which the formation and perception of the image depend,—such as the size and coefficient of refraction of the lens, the extent and character of the retina, and particularly those differences of minute structure which have relation to susceptibility to light, by which the night-flying birds are distinguished from the day-flyers. Nor does the inquiry into the effects of domestication upon the sight appear less interesting.

It is only to point out the various ways in which we may deal with this subject that I have mentioned these different lines of research, and in order that it may be understood that I have not overlooked their importance. It is to one particular property of the eye that my own observations have been chiefly directed, namely the power of accommodation for distance; and I shall endeavour to show that in birds great range of vision depends upon the development and character of the ciliary muscle, to which all are agreed that the power of adjustment is to be attributed.

It is chiefly, then, a comparison of the ciliary muscle in different birds to which I invite attention, assuming the perfection of the sight to depend on this power of accommodation, and that again on the character of the muscle. Let me first mention the general opinion entertained by those who are best acquainted with the habits of that class of birds which astonish us by the rapidity and duration of their flights, namely the pigeons, in regard to the means by which they accomplish them. In his interesting work on this subject Mr. Tegetmeier gives his reasons for concluding that "homing," as it is termed in the Antwerp pigeon, is not the result of "instinct," but of "observation." These pigeons require to be trained stage by stage, or they are certain to be lost. The best of them refuse to fly in a fog or in the dark. They crave in new localities some known landmark; and hence their gradually increasing gyrations, until having descried some familiar object, they recollect their route and fly straight ahead. The objection that no pigeon can possibly see for two hundred miles ahead is met by the details of aëronautic experience. Mr. Glaisher, half a mile aloft in air, could embrace in his "bird's-eye view" the course of the Thames from the Nore to Richmond; and Mr. Wheelwright, though puzzled to account for the flying pigeons "homing" across seas (as from London to Antwerp), which can offer no landmark, is disposed to attribute their power of doing so to their habit of soaring round, circling, and beating about until, sooner or later, they can descry their familiar guide-posts.

My own observations entirely support Mr. Tegetmeier's conclusions. This part of my subject is one of general interest; and I trust that I shall be pardoned for attempting to alleviate the tediousness of anatomical details by this digression.

It must clearly be understood that perfection of sight for very near objects is as important as very extensive range, and that the chief function of the ciliary muscle is to adjust the sight for the former rather than for the latter. When the eye is at rest (that is to say, when the muscle is relaxed) vision of very distant objects is permitted; and it is when the distance is diminished to a very few inches, and in small species of birds to considerably less than an inch, that the action of the muscle is exerted.

The exact functions performed by the ciliary muscle in all those vertebrata in which it exists are still undecided; but it is not difficult to reconcile the accounts which have been given by different anatomists of its structure, if we are aware of the fact that the muscle does not possess the same characters in all classes of animals—indeed, that it is not precisely the same in those that are very nearly allied; so that it is important, particularly in the case of birds, as will be seen, to mention the species under consideration.

It may be stated generally that in birds it is developed in a remarkable degree; in fish it is entirely wanting; in the mammalia it varies directly in proportion to the powers of sight possessed by the species, except in the feline class and in those animals which enjoy the power of nocturnal vision, and in which the ciliary muscle is peculiarly large and differently developed from the same structure in other mammals.

The three specimens which are to be described belong to the Eagle Owl, the Egyptian Vulture, and the Buzzard. They were brought from Egypt by a gentleman who shot the birds himself, and removed the eyes while in the fresh state, preserving them in spirit of wine till he sent them to me.

The eye of the Eagle Owl presents in the most striking degree the peculiar characters of the class to which it belongs. The first of these are its shape and size, too well known to require description, adapted as they are to the very shallow cavities of the orbits.

In the Egyptian Vulture the pyramidal shape of the eye is less remarkable, and a slight approach is observable in it to the spherical globe. In the Buzzard this is still more marked, and the eye resembles as much the eye of the Pigeon as it does that of the Eagle Owl.

In examination of specimens which have been preserved in spirit, it is necessary to restore the pliancy of the tissues of the ciliary muscle by allowing them to remain in water for some days; and I may observe that as this condition must be obtained in order to make satisfactory preparations, the method of using solutions of chromic acid or bichromate of potash to enable the anatomist to make sections is not to be recommended, if the object be to ascertain the dimensions of the muscle and the elasticity of the ligament, which will be presently described. It need hardly be stated that the best mode of treating the eye is to freeze it and then make sections.

The strong plates of bone which exist in the sclerotic of birds preserve the shape of the eye sufficiently well to allow of the dimensions being ascertained after it has been preserved in spirit.

In the Eagle Owl the dimensions are as follow:—

	in.
Diameter of cornea	$\frac{7}{8}$
Diameter of base of eye	$1\frac{9}{32}$
Antero-posterior length	$1\frac{6}{16}$
Lateral diameter of lens	$\frac{9}{16}$
Antero-posterior diameter of lens	$\frac{1}{2}$

The shape of the lens does not appear to be altered by the action of alcohol; but the size is diminished, and the measurements just stated are less than they would be found to be if the lens had been perfectly fresh.

The eye is first to be divided into halves by cutting through the sclerotic, choroid, cornea, and iris. We may regard the sclerotic as a hollow case enclosing a sphere, of which the choroid is the proper covering, and which sphere is attached to its case by tissues of highly elastic and muscular properties, by which a certain amount of movement is capable of being effected in the parts on which the formation of the image depends. It is to be observed, however, that the posterior surface of the choroid is kept in close apposition to the inner and posterior surface of the sclerotic, so that movement of the anterior parts is not communicated to that part on which the optic nerve is expanded. In the eye of the Eagle Owl these conditions are obtained in the following manner.

The whole of the posterior surface of the choroid which corresponds to the optic disk is kept in close apposition to the sclerotic by the direct attachment of the circumference of the part immediately beneath the margin of the retina; it is also fixed where the nerve passes through the sclerotic, while delicate fibres from the choroid keep it in its position at other points.

The anterior part of the choroid, on the contrary, is not in contact with the sclerotic, as the ciliary muscle and the structure I have termed the posterior elastic ligament intervene.

This division of the choroid is not artificial, but is clearly defined by a difference of structure. The posterior part is but slightly vascular, is not elastic, is of considerable tenuity, and has greater resemblance in its general characters to the choroid of fish than to that of the mammalia.

The anterior portion is covered on its internal surface by the ciliary processes, which extend to the angle of curvature of the posterior part of the eye. The tissue of this part of the choroid is of peculiar character; it is dense, strong, and inelastic, and appears to be composed of delicate fibrous tissue. The combination of these characters enables it to preserve its symmetrical shape, and ensure to some degree the preservation of the structures within it. It possesses a rigidity which may be compared to that of ordinary writing-paper, and is of about the same thickness. The anterior part of the choroid is attached to the sclerotic by another structure—a system of fine elastic fibres which pass from the corneal margin of the sclerotic to the line of union between the iris and the choroid, and for which I proposed the name of anterior elastic filaments. Between the anterior elastic filaments and the posterior elastic ligament (a distance in the eye of the Eagle Owl of nearly five eighths of an inch) is interposed the ciliary muscle. The body of the muscle is attached to the line of union of the sclerotic and cornea, so that it may be said to arise from the anterior angle of curvature. The greater part of the posterior portion of the muscle is of delicate tendinous structure; its line of insertion into the choroid is the same as, but on the opposite side of, the line of insertion of the posterior elastic ligament. The breadth of the latter structure is about one eighth of an inch, while the length of the anterior elastic filaments is nearly the same. Thus, passing from before backwards, we have the anterior elastic filaments, the body of the ciliary muscle, its long delicate tendinous portion, and lastly the posterior elastic ligament. To exhibit the structures satisfactorily, the best plan is to make a section of the choroid and sclerotic of one sixteenth of an inch in thickness, and after fixing the two ends of the section on a layer of cork with needles, to dissect the muscle under water or alcohol—a very simple process if a magnifying-glass of an inch focus is employed. It is only necessary to draw the iris gently away from the sclerotic so as to extend the anterior elastic filaments, fixing it with a needle, and then to do the same with the choroid, taking care to hold that membrane at a point posterior to the line of insertion of the posterior elastic ligament.

The length of the ciliary muscle is about three eighths of an inch. I have attempted to preserve sections made in this way in Canada balsam, but have found that rupture of the ligament usually takes place, I presume from its tenacity being destroyed by the action of the fluid. It is on that part of the choroid which lies between its two lines of attachment, on its internal surface, that the ciliary processes are developed, and to the anterior part of those processes that the crystalline lens is attached. Contraction of the ciliary muscle, it is reasonable to suppose, would produce a change in the position of the lens, and would take place when the object to which the sight was directed was close to the eye—that is to say, the muscle is employed in accommodation for short range of vision. The position of rest is restored by the posterior elastic ligament, which acts in direct opposition to the muscle.

The eye of the Vulture is smaller than that of the Owl, is not so decidedly pyramidal in shape, and may be placed between the latter and the eye of the Buzzard. The chief difference, however, between them is in the greater degree of concavity which the posterior portion of the sclerotic assumes; so that in the Owl the retina lies on a flatter surface than in the Buzzard, while in that respect the Vulture is between the two.

The dimensions of the eye of the Vulture are as follow:—

	in.
Diameter of cornea	$\frac{9}{16}$
Lateral diameter of the sclerotic in its broadest part	$1\frac{3}{16}$
Antero-posterior diameter of eye	$\frac{15}{16}$
Length of ciliary muscle	$\frac{9}{32}$
Breadth of the posterior elastic ligament	$\frac{1}{10}$
Length of the anterior elastic filaments approximately the same.	

With regard to the anterior elastic filaments and the posterior elastic ligament, it is unnecessary to make further remark, beyond that they resemble those structures in the eye of the Owl.

In the Buzzard the dimensions of the eye and its structures are as follow:—

	in.
Diameter of cornea	$\frac{4}{10}$
Lateral diameter of eye	1
Antero-posterior diameter of eye	$\frac{3}{4}$
Length of ciliary muscle	$\frac{3}{16}$
Length of posterior elastic ligament	$\frac{1}{16}$
Length of anterior elastic filament	

In order to ascertain the mechanical effect produced by the ciliary muscle, the simple experiment may be performed of applying traction, by means of a pair of forceps, on the choroid, the dissection being arranged and fixed as I have described. It will readily be seen that the elastic ligament acts in direct opposition to the muscle, and in the living eye has the power of restoring the parts to the condition of rest.

The ciliary muscle is composed of striated fibre of very distinct character. It varies, as is seen in the three examples described, in length and amount of muscular tissue. The tendon in the Owl is long and the body of the muscle short; but in the other species, as in most birds, the muscular fibres extend to a great length, if not entirely from the origin to the insertion of the muscle. These minute differences should be pointed out in detail in the case of each species of bird.

The elastic ligament is composed of very delicate elastic tissue, the microscopical character of which is well defined.

On the peculiar nature of the anterior elastic filaments I beg to postpone any decided opinion.

With regard to the nerves which supply the ciliary muscle and the iris, I have no particular remarks to offer, as the description which I gave some years ago of the ganglia and plexuses on the ciliary nerves in the eye of the Pheasant will apply generally to all birds. Whether the contraction of the iris and the accommodation of the sight be voluntary or involuntary actions on the part of birds we cannot say positively; I am inclined to believe that the latter is the case.

For the sake of convenience, and to render any further researches on the dimensions of the different parts of the eye in other species of birds symmetrical with those contained in this communication, I have arranged the principal facts in a tabular form (see p. 148).

From this Table we may draw the following conclusions:—that in the Eagle Owl the range of vision is small, the power of accommodation very rapid; in the Vulture range of vision is great, the power of accommodation considerable, but slower than in the Owl; in the Buzzard the range of vision is greater still, and the power of accommodation capable of being readily and extensively exercised.

These conclusions, I think, will be found to accord with the observations of those who have had opportunities of making themselves acquainted with the habits of the birds during life.

It has been usual for those who have devoted much attention to the physiology of vision to propose some original and independent explanation of the means by which accommodation for distance is effected, if their researches have been attended with the observation of any previously unknown facts connected with the subject, either experimental or anatomical. It appears to me that as yet we have not sufficient data to afford a perfectly satisfactory explanation of that remarkable property possessed by the eye, partly on account of the difficulty of ascertaining the exact functions of different structures, and particularly by reason of the very various conditions which the same structures assume in various species of vertebrate animals. The line of investigation which is pointed out in this communication it is by no means certain will assist in the solution of the problem of the means by which adjustment for distance is effected; but I am inclined to think that we have not yet exhausted all the resources which careful anatomical inquiry places at our command, and that when a sufficient number of details have been collected, the subject will be in a more suitable state for the application of optical laws than it is at present.

	Eagle Owl.	Egyptian Vulture.	Buzzard.
Diameter of cornea	·875	·506	·4
Greatest diameter of sclerotic (transversely)	1·312	1·182	1
Antero-posterior diameter	1·375	·932	·75
Diameter of lens (transversely)	·506	Not recorded.	·343
Antero-posteriorly	·5	....	·22
Length of ciliary muscle	·375	·3	·187
Breadth of posterior elastic ligament	·125	·1	·063
Length of anterior elastic filaments	·125	·1	·063
Character of ciliary muscle	Body short, tendon long.	Muscular fibres form more than three fourths of it.	Muscular fibres extend from origin to insertion.

Supplement, containing a description of the Eye in *Rhea Americana, Phœnicopterus antiquorum*, and *Aptenodytes Humboldtii* :—

In the American Ostrich the eye is large, and the structures concerned in the adjustment for distance are well developed. In the Ostrich (*Struthio camelus*) the observation was first made by Sir P. Crampton of the existence of the ciliary muscle; and as the views of physiologists regarding the mechanical functions of the muscle in the accommodation of sight were various, while numerous inquiries were made very soon after the publication of this new anatomical fact, I am gratified in having the opportunity of pointing out the cause of the discrepancies in opinion which have continued to the present time.

The description which Crampton has given is correct so far as it goes, but it was limited to that part of the ciliary muscle which forms the thickest portion of it—that is to say, the dense part which lies closest to the margin of the cornea. The tendon of the muscle and its insertion into the choroid were not observed by Crampton, and the structure termed the posterior elastic ligament was overlooked. It can thus be explained how it was that the deflection of the margin of the cornea and consequent change in its curvature were advanced as the means by which accommodation was effected.

The eye of *Rhea americana* appears to be very similar to that of *Struthio camelus*, though not quite so large. The globe is of irregular shape, and bulges out both laterally and vertically; its diameter in the former direction is an inch and two thirds, in the latter an inch and a half, and antero-posteriorly an inch and one third

The sclerotic is not particularly thick, and contains but slightly developed osseous structure. The crystalline lens is about half an inch in its lateral diameter, and one third of an inch in its antero-posterior diameter. The ciliary muscle is large and strong, the body thick, and the fibres diminishing in size as they become tendinous near their insertion; its length is $\frac{3}{16}$ inch.

The anterior and posterior elastic ligaments are each about $\frac{3}{16}$ inch in length, though it is to be understood that their elasticity is so great that they might be stretched to a considerably greater length.

In the first part of this communication I expressed some doubt regarding the microscopical character of the anterior elastic ligaments; indeed the term ligament was not applied to them, as they did not possess the same distinct character as the posterior elastic ligament.

In all the species of birds which have come under my observation, the microscopical character of the last-mentioned structure was the same. In the *Rhea* the anterior elastic filaments are distinctly composed of the same kind of elastic fibres; their colour is a light grey; they coil up very readily when torn from one another with needles; they are to some extent covered with fine granular or spongy tissue, which at first conceals their elastic character; they are continuous and of equal diameter from their origin to their insertion, and are united more closely than in most birds, so that the filamentous character so clearly seen in the Owls is not observed.

A more complete investigation into the anatomy of this part of the subject allows of the conclusion that the anterior elastic filaments are composed of cellular and elastic tissue combined in different proportions, and that the differences in their strength, elasticity, and appearance depend on the collection of the filaments into fibres of varying sizes, or their approximation so as to form a continuous suspensory band between the iris and the cornea.

The iris in this bird is not composed entirely of muscular fibres as in many other genera, but is soft and spongy in its general character, and more like the iris in mammalia than in birds.

As it is desirable to limit myself to those particular structures which are concerned in the accommodation of the eye for distance, deferring for the present certain general conclusions which fresh observations are required to confirm, I shall leave to the consideration of the naturalist the subjoined facts arranged in a tabulated form, and which appear to me to be applicable to the explanation of the habits of the birds by anatomical peculiarities.

	Cornea.	Sclerotic.	Lens.	Ciliary Muscle.	Elastic ligament.	
					Posterior.	Anterior.
	in.	in.	in.	in.	in.	in.
Rhea americana.........	vertical $\frac{5}{8}$ lateral $\frac{5}{8}$	vertical $1\frac{1}{4}$ lateral $1\frac{3}{8}$ ant.-post. $1\frac{1}{10}$	lateral $\frac{11}{16}$ ant.-post. $\frac{3}{8}$	$\frac{1}{16}$ fibres long.	$\frac{1}{16}$	$\frac{1}{16}$
Phœnicopterus antiquorum	vertical $\frac{5}{8}$ lateral $\frac{1}{16}$ more.	lateral $\frac{3}{4}$ ant.-post. $\frac{5}{8}$	lateral $\frac{5}{16}$ ant.-post. $\frac{3}{16}$	$\frac{1}{16}$ gradually diminishing.	$\frac{1}{32}$	$\frac{1}{32}$
Aptenodytes Humboldtii	$\frac{5}{8}$	lateral $\frac{7}{8}$ ant.-post. $\frac{7}{8}$	lateral $\frac{5}{16}$ ant.-post. $\frac{5}{16}$	$\frac{1}{16}$ gradually diminishing.	$\frac{1}{16}$	$\frac{1}{16}$

MISCELLANEOUS.

On the name Tethya *and its Varieties of Spelling.*

By Dr. J. E. Gray, F.R.S. &c.

Lamarck established the genus *Tethya* in the first volume of the 'Annales du Muséum' and in the 'Hist. Nat. des Anim. sans Vert.' ii. p. 384 (1816). As usual in the latter work he uses the French generic name *Téthie* and prints it in capitals, and the Latin generic name *Tethia* in common Roman characters: but the *i* is evidently an oversight or misprint; for to each of the six species he gives the name of *Tethya*, and it is so in the second edition. This name so written has been almost universally followed.

Dr. Johnston, in his 'British Sponges,' p. 81, writes it "*Tethea*, Lamarck," but quotes *Tethia* or *Tethya*, Lam., les *Thethyes*, Cuv., and *Tethium*, Blainv., and observes it is not the "*Tethea* of Pliny," and that Bohadsch has given the name of *Tethyum* to the *Tethis* of Linnæus.

Dr. Bowerbank, in his 'British Sponges' (i. p. 181 and ii. p. 6), adopts Dr. Johnston's name of *Tethea*, but quotes it as Lamarck's, probably from Johnston. In the next page he quotes Milne-Edwards's edition of Lamarck, and gives *Téthie* as the French and *Tethea* erroneously as the Latin name, and quotes *Tethea lyncurium* and *T. cranium* as types, names not found in Lamarck.

Note on the Systematic Name of the Walrus. By Dr. W. Peters.

Although Steenstrup and Sundevall, nearly thirteen years ago, showed that Linné, in the first edition of his 'Systema Naturæ' (1735), applied the generic name *Odobænus* to the walrus, and that at the same time the name *Trichechus* had been given by Artedi and Linné alike to the manatee, which they then considered to belong to the class of fishes, it seems that these facts have not been so much appreciated as they ought to be. Linné continued to apply the name *Trichechus* exclusively to the "hairy" fish, which he afterwards united with *Elephas*, *Bradypus*, *Myrmecophaga*, and *Manis* in his order Bruta. This may be seen even as late as the tenth edition of the 'Systema Naturæ' (1758), wherein the walrus figures at the same time as *Phoca rosmarus* amongst the Feræ. Only in the twelfth edition of his 'Systema Naturæ' (1766), p. 49, Linné added the walrus, as a second species, to the manatee in Artedi's genus *Trichechus*, upon the presumption that it had "dentes primores nullos utrinque."

It seems therefore quite clear that it is wrong to apply the generic name *Trichechus* (belonging to the manatee) to the walrus.

We have another, quite analogous case in zoology of the misapplication of a generic name, namely that of *Ursus labiatus*, which, in consequence of losing its front teeth easily, was transferred from the Feræ to the Bruta or Edentata, and stands as *Bradypus ursinus* in the systematic arrangements of Pennant and Shaw. But no one, I think, would contend that we ought to apply the name *Bradypus*, previously used for the Sloths, to the *Ursus labiatus*.

The Clustered Sea-Polype (Umbellula grœnlandica). By Dr. J. E. Gray, F.R.S. &c.

Two specimens of this very rare and extraordinarily large Radiate animal from Greenland were obtained during the Swedish expedition of the frigate 'Eugenia' to the Northern Ocean. Only two specimens had previously been seen, which were obtained by Captain Adrians on the coast of Greenland, and described by M. Christlob Mylius in 1754, and by Ellis in Phil. Trans. vol. xlviii. p. 305. These specimens are believed to be no longer in existence; so that the rediscovery of this animal is most important, and we await the description of it in the zoology of the voyage with impatience. (See Gray, Ann. & Mag. Nat. Hist. 1860, v. p. 25, and Cat. Sea-Pens in Brit. Mus. p. 39.)

Ziphius Sowerbiensis.

Mr. William Andrews informs me that they have received a fine perfect skeleton of this rare whale at the Dublin Museum. This is the third specimen taken on the west coast of Ireland in the last few years; they were all males and have two large well-developed teeth like the specimen figured by Sowerby.—Dr. J. E. Gray.

Marine Sponges in the British Museum.
By Dr. J. E. Gray, F.R.S. &c.

Mr. Carter has examined with the microscope, figured, and described in a preliminary manner, the species of sponges in the British Museum, and has determined that there are more than six hundred species of that group in the collection, which he is now describing in detail. Every day brings forward important additions to this immense class, showing that at present we have a very imperfect knowledge of the sponges in existence; and as yet we have not received any sponges from the Persian Gulf, the beautiful islands of the Pacific, or from the shores of the northern parts of that ocean, and many other localities.

Habits of Terebratula truncata. By Dr. J. E. Gray, F.R.S. &c.

Mr. Atherstone has presented to the British Museum a series of specimens of *Terebratula truncata* from the S.E. coast of the Cape of Good Hope, showing that this species, unlike the *Terebratulæ* from the Australian seas, which are generally found on stones and rocks, lives in groups, composed of specimens of all ages, on the stems of the larger Algæ, and also on the larger species of *Ascidia*. The shells vary greatly in the radiating grooves, some being very distinctly ribbed and others smooth, even in the same group.

On the Reproduction and Mode of Life of the Phyllopoda.
By Dr. Friedrich Brauer.

The author observed these Crustacea in aquaria. He succeeded repeatedly in rearing both sexes of *Apus cancriformis*, Linn., from the ova, and in witnessing the act of fertilization. In this, the male places himself upon the carapace of the female, and then strikes repeatedly and quickly with the part of his body which is free from the carapace upon the ventral surface of the female, during which process the seminal matter is evacuated. The male of *Apus cancriformis*, Linn., and that of *Apus numidicus*, Grube, constantly possess one footless segment more than their females. Thus the male of *Apus cancriformis* presents seven, and the female six footless segments at the extremity of the body; whilst the male of *Apus numidicus* has nine, and the female eight. The author has also repeated the experiment made more than a hundred years ago by Schäffer, and, taking a female in the *Nauplius*-stage, brought it up in an isolated condition—by which means he obtained ova which were certainly unfecundated, and from which only females were developed, the eggs of which again furnished only female Phyllopoda as a third generation. In opposition to this he obtained chiefly males from the ova of fecundated females. In conclusion, the author refers to the breeding of these and other Phyllopoda in aquaria in accordance with the method invented by Prazak, and describes briefly the mode of life of *Branchipus stagnalis*, Linn., and *Estheria dahalacensis*, Rüpp.—*Anzeiger der Akad. der Wiss. in Wien*, May 31, 1872, p. 100.

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[FOURTH SERIES.]

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XXIII.—*Note on some Fossil Monkeys found in Italy, preceded by a Review of the Fossil Quadrumana in general.* By C. J. Forsyth Major, M.D.[*]

We shall commence this review of the fossil monkeys hitherto described with the *monkeys of the Eocene strata.*

As early as 1839 Messrs. Lyell and Owen indicated in the London Clay of Kyson (in Suffolk) some mandibular teeth of a quadrumanous animal which Prof. Owen at first named *Macacus eocænus*[†] and afterwards *Eopithecus*. In 1862 the same author in a short note[‡] declared that the fossils in question ought very probably to be referred to a species of *Hyracotherium* (*H. cuniculus*), a pachyderm of which only the teeth of the upper jaw were previously known. In a collection of fossils from the above-mentioned locality, Prof. Owen had met with, on the one hand, a series of upper molars of the type of *Hyracotherium*, and on the other a series of lower molars analogous to those previously described under the name of *Macacus eocænus*, and likewise resembling the mandibular teeth of *Pliolophus*, a genus allied to *Hyracotherium leporinum*. From this circumstance it becomes probable that the upper and lower teeth may have belonged to one and the same species; but as to the conclusion that all these remains originated from a pachyderm of the genus *Hyracotherium*, this does not seem to me, at present at least, sufficiently well-founded. The mandibular teeth of the supposed *Hyracotherium cuniculus* certainly present more analogy with the Macaques than with *Pliolophus vulpiceps* (and this, indeed, is admitted by Prof. Owen himself); and as regards the upper teeth, as Prof. Owen has figured and described them*, they appear to me to present as many affinities with certain Quadrumana as with the teeth of *Hyracotherium leporinum* to which Prof. Owen compares them.

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[*] Translated by W. S. Dallas, F.L.S., from the 'Atti della Società Italiana di Scienze Naturali,' vol. xv. pp. 79–95.

[†] Annals of Nat. Hist. ser. 1. vol. iv. p. 189, Nov. 1839.

[‡] "On the Hyracotherian character of the Lower Molars of the supposed *Macacus* from the Eocene Sand of Kyson, Suffolk," Ann. & Mag. Nat. Hist. ser. 3. vol. x. p. 240, 1862.

In 1862 M. Rütimeyer described a fragment of a monkey derived from the Jura of Soleure, from the siderolitic deposit (*Bohnerz*) of Egerkingen, which, from the general character of the remains of Mammalia composing its fauna, is regarded as contemporaneous with the Calcaire Grossier of Paris. The fossil in question, which consists of a fragment of the right maxillary furnished with the three true molars, is ascribed by M. Rütimeyer to a monkey which combined the form of cranium characteristic of the Marmosets with the dentition and size of a *Mycetes*, at the same time by its dentition reminding us of the Lemuridæ †.

Among the fossil rodents derived from the same locality, which were intrusted to me some time since by the intervention of M. Rütimeyer, there was a left last inferior molar, which I ascribe, although with some doubt, to *Cœnopithecus lemuroides*, the name given by M. Rütimeyer to the monkey from Egerkingen. The difference between this tooth, which I shall shortly publish, and the corresponding molar of *Mycetes* is not greater than that between the upper molars of this same genus and the teeth described by M. Rütimeyer. The relative size likewise corresponds.

Miocene Monkeys.—The greater part of the fossil monkeys known up to the present day belong to the Miocene deposits. Dr. Falconer and Sir Proby Cautley were the first ‡ who found remains of monkeys in a fossil state; their communication upon this discovery, which was made in the probably Miocene strata of the Sewalik Hills in Northern India, bears date November 24, 1836. The astragalus in question agrees perfectly in size with the same bone in *Semnopithecus entellus*;

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* A History of British Fossil Mammals and Birds, 1846, p. 424, figs. 170, 171.

† L. Rütimeyer, 'Eocäne Säugethiere aus dem Gebiet des schweiz. Jura,' p. 88 (Neue Denkschriften der allg. schweiz. Gesellsch. für die ges. Naturwiss. Band xix. 1862).

‡ See for what relates to the question of priority, Falconer, "Note on a Correction of published Statements respecting Fossil Quadrumana," Pal. Memoirs, &c. 1868, vol. i. pp. 309–314.

the differences between the two bones in details of form were only appreciable by means of compasses[*].

The second document attesting the presence of monkeys in the Sewalik Hills is a right upper jaw found soon afterwards by Baker and Durand near the Sutlej. According to these authors it presents analogies with the genera *Macacus* and *Cynocephalus*, but still more with *Semnopithecus*; but it indicates an animal of the size of the orang (*Pithecus satyrus*), far larger than the *Semnopitheci*[†].

It is further to the researches of Falconer and Cautley that we owe the knowledge of three other Quadrumana from the same strata—namely, the upper jaw of a species allied to, but larger than *Semnopithecus entellus*[‡], two fragments of the lower jaw of a species allied to *Macacus rhesus*[§], and, lastly, the extra-alveolar portion of a left upper canine, indicating a species allied to the orang[||].

On the 16th of January, 1837, Lartet communicated to the Academy of Sciences of Paris the discovery made by him, in December 1836, in the Miocene freshwater deposit at Sansan, of a quadrumane which he at first united with the living genus *Hylobates*, but which he subsequently named *Pliopithecus antiquus*, adopting the opinion already pronounced by Is. Geoffroy and M. Gervais[¶].

An allied species was found about ten years ago in the upper freshwater Molasse at Elgg (in the canton of Zurich). It is a very fine upper jaw, whilst from Sansan we know only the lower jaw: it has been described by M. Biedermann[**] and by M. Heer[††]; and the latter gives an excellent figure of it.

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[*] Cautley and Falconer, "Notice on the Remains of a Fossil Monkey from the Tertiary Strata of the Sewalik Hills in the north of Hindustan" (dated November 24, 1836, read June 14, 1837), Trans. Geol. Soc. Lond. 2nd ser. vol. v. p. 499. Reprinted in Falconer's Palæont. Mem. vol. i. p. 292, figs. 6–9 (p. 294).

[†] Baker and Durand, "Sub-Himalayan Fossil Remains of the Dadoopoor Collection," Journ. Asiatic Soc. Nov. 1836, vol. v. p. 739. Reprinted in Falconer's Palæont. Mem. vol. i. p. 298, pl. 24. figs. 1, 2.

[‡] Falconer and Cautley, "On additional Fossil Species of the order Quadrumana from the Sewalik Hills," Journ. Asiatic Society, May 1837, vol. vi. p. 354. Reprinted in Falconer's Palæont. Mem. vol. i. pp. 300–307, pl. 24. figs. 3, 4.

[§] *Ibid.* pl. 24. figs. 5–8.

[||] *Ibid.* fig. 11 (p. 304). Falconer "On additional Quadrumanous Remains from the Tertiary Deposits of the Sewalik Hills," Palæont. Mem. vol. i. pp. 307–309.

[¶] Lartet, 'Notice sur la colline de Sansan &c.,' Auch, 1857; Comptes Rendus, 1856, tome xliii. pp. 219–223. For the complete literature of this species see Gervais, Zool. et Paléontol. Françaises, edit. 2. p. 8.

[**] Petrefacten aus der Umgegend von Winterthur, Heft ii. Die Braunkohlen von Elgg (Winterthur, 1863), p. 14.

[††] Die Urwelt der Schweiz (Zurich, 1865), pp. 418, 419, pl. 11. fig. 4.

M. Biedermann had given to the fossil the name of *Pliopithecus platyodon*; M. Rütimeyer, on the other hand (Heer, *l. c.*), regards the jaw from Elgg as belonging to the same species as those of Sansan, which he names *Hylobates antiquus.* However, considering how slight are the specific and even the generic differences presented by the dentition of the living monkeys, we shall be disposed rather to accept for the fossils in question two distinct species and to refer them to a distinct genus. The *Pliopithecus antiquus* of Sansan approaches the anthropomorphous apes more than *P. platyodon*, on account of the blunter tubercles of its molars, which indicate a more frugivorous diet. Lartet has demonstrated that the true molars of the Sansan jaw even present more resemblance, apart from size, to those of the gorilla than to those of *Hylobates*, especially the last molar (m^3), which is longer than the penultimate one; and this is not the case in the Gibbons*. *P. platyodon*, on the contrary, diverges from the anthropomorphous apes by the form of its molars, which are furnished with less rounded tubercles and with more trenchant crests. The differences presented by the incisors and canines of *Pliopithecus platyodon* when compared with those of the genus *Hylobates* have been indicated by M. Biedermann and by M. Rütimeyer himself (Heer, *l. c.*).

The second quadrumane of which Lartet presented a description to the Academy, in 1856 (*l. c.*), *Dryopithecus Fontani*, also belongs to the anthropomorphous group. It was found in a bed of marly clay situated at the base of the plateau on which the town of St. Gaudens (Haute-Garonne) is built, a locality belonging to the same geological horizon as Sansan. The remains consist of two halves of a lower jaw with the ascending rami truncated, together with the symphysary region of the jaw and a humerus, the whole indicating an individual still young but of large size. The last molar on each side was not yet in its place; nevertheless the jaw bears the teeth of the second set: this is what occurs in the human species, whilst among the monkeys in general, according to Lartet, the cutting of the last molar always precedes the shedding and replacement of the milk teeth. The crowns of the hinder molars present the five blunt points which characterize the lower molars of the higher apes and those of man. "To sum up, this fossil, with characters of inferiority in certain points of view, takes its place in the group of anthropomorphous apes, which includes the Chimpanzee, the Orang, the Gorilla, the Gibbons, and the species of the fossil genus *Pliopithecus.*"

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* See the excellent figures which have been given of the dentition of *Hylobates syndactylus* by Gervais (Hist. Nat. des Mammifères, 1854, p. 49) and Giebel (Odontographie, pl. 1. fig. 8).

Prof. Owen, on his part, is of opinion that the mode of succession of the teeth, as well as their conformation and relative size, indicate the near affinity of *Dryopithecus* to the *Pliopitheci* and recent Gibbons, and that this is the only conclusion we can justly draw from the examination of the fossils*. I have before me the skull of a *Macacus rhesus* that I myself prepared. The teeth of the second set are in their places, whilst the last molar, although perfectly developed, had not yet pierced the gum, nor even the bone completely. This mode of replacement, therefore, is by no means a proof of superiority, the Macaques being very inferior to the anthropomorphous apes.

The palæontologists of Württemberg also cite *Dryopithecus Fontani* from several localities in the Suabian Alps (Salmendingen, Ebingen)†, in what M. Quenstedt calls the second mammalian fauna of the siderolitic strata; the isolated molars found were at first taken for human teeth‡.

In his fine monograph of the Miocene fauna of Steinheim in Württemberg, which, like the preceding locality, presents much analogy with Sansan, M. Fraas describes the remains of a quadrumane (*l. c.* pp. 150–153, pl. iv. fig. 1). He figures the four posterior teeth of the left mandible, which belong, according to him, to a species of *Colobus* (*C. grandævus*). The *Colobi*, as is well known, are distinguished from the *Semnopitheci* only by the want of a thumb on the anterior limbs; A. Wagner was even unwilling to separate them from the latter genus§. M. Gervais also says of the *Colobi*, in comparing them with the *Semnopitheci*, that "their teeth present the same characters so nearly as to be mistaken"‖. I cannot but confirm these statements from two skulls (of *C. guereza* and *C. ursinus*) which I have had the opportunity of comparing. The posterior appendix which M. Fraas describes as characteristic of the first and second true molars of the *Colobi*, occurs likewise in the unworn teeth of several *Semnopitheci*, and still better developed in the Macaques, as well as on the anterior side. The third lower molar of *Colobus* is described by M. Fraas as furnished with a terminal bicuspid talon, which resembles a third pair of ridges. In any case this division of the terminal talon into two points could only be very shallow;

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* Proc. Zool. Soc. Lond. part xxvii. 1859, p. 18.

† Fraas, "Die Fauna von Steinheim mit Rücksicht auf die miocänen Säugethier- und Vogelreste des Steinheimer Beckens," Württ. naturw. Jahreshefte, Jahrg. xxvi. (1870), pp. 145–306.

‡ Quenstedt, 'Handb. der Petrefactenkunde,' 2te Aufl. (1865), p. 32, fig. 1.

§ Schreber's Säugethiere, Supplementband, 5te Abth. (1855), p. 35.

‖ Hist. Nat. des Mammifères, 1854, p. 64.

in the two species before me, of which the teeth are not much worn, there is only an unpaired terminal talon.

I may remark here that the last lower molar of some species of Macaques, such as *Macacus* (*Inuus*) *ecaudatus*, is characterized by a terminal talon subdivided into three parts, whilst in others there are only two divisions. With regard to the *Semnopitheci* it is only in young individuals that we see a faint indication of a division of the terminal talon, which occurs somewhat approximated to the inner side, whilst in *Colobus guereza* it occupies more nearly the middle of the posterior margin; this is the only difference which I have been able to detect in the dentition of the two genera. Thus it would appear that it is only with some reservation that the determination given by M. Fraas must be accepted.

It is in the deposit of Pikermi, in Attica, that the most numerous remains of Quadrumana have been found, but always represented by a single species, *Mesopithecus pentelici*, A. Wagn., which possesses the cranium and dentition of the *Semnopitheci* and the limbs of *Macacus**. Of this M. Gaudry sent to Paris the remains of twenty-five individuals; at Munich there are also numerous remains of it, and the Museum of Milan possesses some fine crania.

I will conclude the examination of the Miocene Monkeys by referring to the discovery in the sands of Eppelsheim (Rhenish Hesse) of a fossil ascribed to a monkey†. Eppelsheim is of the same age as Pikermi; it is therefore possible that the same species may occur in both localities; nevertheless it would appear that the remains found at Eppelsheim are not sufficient to allow of exact determination.

Monkeys from Deposits more recent than the Miocene.—The name of *Macacus pliocœnus* was given by Prof. Owen to a fragment of a maxillary containing the penultimate right upper molar, most nearly resembling the corresponding tooth of *Macacus sinicus*. The deposit in which the specimen was found is a bed of yellowish sand between two beds of brick-earth situated near the village of Gray's Thurrock, in the county of Essex‡. M. Beyrich thinks that the denomination given by Prof. Owen is arbitrary, the tooth in question presenting only insignificant differences in the genera *Inuus*, *Cercopithecus*, and *Semnopithecus**. Nevertheless, as this tooth possesses the general form and the mode of wear which characterize *Macacus* and distinguish it from *Semnopithecus*, I do not think that there is any reason to change the name adopted by Owen into "*Semnopithecus pliocænus*" (Beyrich, *l. c.* p. 24), and the less as the occurrence of the genus *Macacus* in the fossil state is now placed beyond doubt.

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* A. Gaudry, 'Animaux fossiles et Géologie de l'Attique,' 1862, p. 18. See also this work for the complete literature of *Mesopithecus*.

† H. von Meyer, "Die fossilen Reste des Genus *Tapirus*," Palæontographica, Bd. xv. (1867) p. 164.

‡ Owen, "Note sur la découverte, faite en Angleterre, de restes fossiles d'un quadrumane du genre Macaque, dans une formation d'eau douce appartenant au nouveau pliocène," ComptesRendus, tome xxi. Sept. 1845, pp. 573–575. The specimen is figured in Owen's 'British Fossil Mammals and Birds,' 1846, pl. xlii. figs. 1–3. I do not find *Macacus pliocœnus* mentioned in the enumeration given by Mr. Boyd Dawkins (Quart. Journ.

There is only a single point which leads to doubt in the figure given by Prof. Owen, which shows the inner tubercles of the teeth distinctly separated, in a manner such as I have not met with in any of the living species of *Macacus*. Nor is it a peculiarity of the *Semnopitheci*; in the molars of both these genera the inner tubercles are united by well-marked diagonal crests.

The few isolated teeth which M. Gervais has described under the name of *Semnopithecus monspessulanus* were found by him at Montpellier in the freshwater marls of the Pliocene stage†. According to M. Gervais it is possible that *Semnopithecus monspessulanus* is of the same species as the monkey from the marine sands which M. de Christol has named *Pithecus maritimus*‡, comparing it especially to the genus *Cercopithecus*, but without giving either a detailed description or figure of it.

From the same deposits, according to M. Gervais, are derived a series of four right lower molars, two canines, and one incisor, named by him *Macacus priscus*§.

Lastly, the Danish naturalist Lund found in the Brazilian caves five species of platyrrhine monkeys, one of which, *Protopithecus brasiliensis*, found nearly at the same time (July 1836) as the first remains of Quadrumana in Asia, sur-

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Geol. Soc. vol. xxiii. 1867, p. 101, and vol. xxv. 1869, p. 199) of the fossil Mammalia of these deposits at Gray's Thurrock, which are as follows:—*Felis spelæus*, *F. catus*, *Hyæna spelæa*, *Ursus*?, *U. arctos*, *Canis lupus*, *C. vulpes*, *Lutra vulgaris*, *Bos primigenius*, *Bison priscus*, *Megaceros hibernicus*, *Cervus elaphus*, *Elephas antiquus*, *E. priscus*, Goldf., *Equus fossilis*, Owen, *Rhinoceros hemitœchus*, Falc., *R. megarhinus*, Christ. (=*R. leptorhinus*, Cuv.), *Sus scrofa*, *Hippopotamus major*, *Castor fiber*, *Arvicola amphibia*. We shall recur hereafter to the question of the age of the brick-earths of the valley of the Thames.

* "Ueber *Semnopithecus pentelicus*," Abhandl. Akad. der Wiss. zu Berlin aus d. Jahre 1860, p. 23 (1861).

† P. Gervais, "Note sur une nouvelle espèce de Singe fossile," Comptes Rendus, tome xxviii. 1849, p. 699; and Zool. et Paléont. Françaises, 2nd ed. 1859, p. 10.

‡ Bull. Soc. Géol. de France, 2^e sér. tome vi. p. 173.

§ Zool. et Paléont. Franç. p. 11.

passed in size the largest of the American monkeys now living, the *Mycetes*, with which it had some relations. Subsequently the same naturalist discovered successively remains belonging to two species of *Jacchus* (*J. grandis*, *J.* aff. *penicillato*), and to the genera *Callithrix* and *Cebus*[*].

I cannot say whether the two species of monkeys allied to the genera *Mycetes* and *Cebus* that P. von Claussen has also discovered in the Brazilian caves belong to the *Protopithecus* and *Cebus* described by Lund. They are known to me only by the short note of the former naturalist[†].

Summarizing the indications just given we get at the number, nineteen species, of fossil monkeys described in detail. Of the two suborders of Primates[‡] the Lemuridæ have as yet no representatives in the fossil fauna. Nevertheless the Eocene genus *Cœnopithecus* is to a certain extent intermediate between the Lemuridæ and the Simiadæ, combining at the same time certain characters of two families of Simiadæ (*Arctopithecini* and *Platyrrhini*). The first family of the Simiadæ, that of the Arctopithecini, is represented by the two species of *Jacchus* from the limestone caves of Brazil. To the second, that of the Platyrrhini, belong the other monkeys discovered in these same caves, to the number of three, or perhaps of five species.

All the other fossil remains belong to the family of the Old-World monkeys, the Catarrhini—the majority to the *Cynomorpha*, represented by three or four species of *Semnopithecus*, three species of *Macacus*, and the *Mesopithecus* of Pikermi (which is, so to speak, intermediate between the other two genera mentioned)[§]. Lastly, the *Anthropomorpha* are represented by four species, three of which belong to two extinct genera allied to *Hylobates*, whilst an animal very similar to the Orang is indicated by a single canine.

The following is the geographical distribution of the fossil Quadrumana:—

In South America, from five to seven species, belonging to at least four genera, one of which is extinct: *Protopithecus*, *Jacchus*, *Cebus*, *Callithrix*.

In India (Sewalik Hills), four or five species, referable to three living genera: *Macacus*, *Semnopithecus*, *Pithecus satyrus*.

In Greece, one species of an extinct genus, *Mesopithecus*.

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[*] Lund, "Blik paa Brasiliens Dyreverden för sidste Jordomvæltning," in Kongl. Danske Vidensk. Selsk. Naturv. og Math. Afhandl. 8–12 Deel, Copenhagen, 1841–1845.

[†] Neues Jahrbuch für Miner. &c. Jahrg. 1845, p. 174.

[‡] See, for the subdivisions of the order Primates, Huxley, 'A Manual of the Anatomy of Vertebrate Animals,' 1871.

[§] I have passed over *Colobus grandævus*, Fraas, the determination of which appears to me still doubtful.

In Germany, two or three species, belonging to at least two genera: *Dryopithecus Fontani* (genus extinct), *Colobus? grandævus.*

In France, four species, belonging to four different genera, two of which are extinct: *Pliopithecus antiquus*, *Dryopithecus Fontani*, *Semnopithecus monspessulanus*, *Macacus priscus.*

In Switzerland, two species, belonging to two extinct genera: *Cænopithecus lemuroides*, *Pliopithecus platyodon.*

In England, one species of a living genus: *Macacus pliocænus.*

The *Eocene* deposits have hitherto furnished a single species of which the determination appears to be certain, the *Miocene* nine or ten, the *Pliocene* two, and the *Postpliocene* a single one, leaving out of consideration the fossils buried in the caverns of Brazil, which probably also belong to the Postpliocene.

Fossil Monkeys discovered in Italy.—Until quite recently fossil monkeys were unknown in the different fossiliferous formations of Italy. The specimen which I lay before the Society belongs to the palæontological collection of the Civic Museum of Milan (Cat. no. 849). Derived from a private collection, this fossil was sent to the Marquis C. Ermes-Visconti, who presented it to the Museum. Prof. Cornalia, Director of the Museum, has been kind enough to allow me to examine it; and I take advantage of this opportunity to express my thanks to him for this. Unfortunately the exact derivation of this interesting specimen is unknown; the ticket which accompanied it was inscribed "Val d'Arno inferiore." Inquiries made to ascertain its origin were without result; nevertheless, for various reasons, it is more probable that the fossil is derived from the upper Val d'Arno. We shall have to recur to the reasons which lead me to accept this supposition; I shall only remark here that fossils of terrestrial Mammalia are rare in what is called the lower Val d'Arno.

The specimen in question, which is imbedded in a kind of greenish and very soft marly grit, consists of a fragment of a right upper jaw containing the three true molars in position. Of the premolars there is no other trace than three alveoli, which, judging from their respective situations, belonged to the two outer roots of the last premolar and to the postero-external root of the first; in the middle alveolus there is a small fragment of the root. The enamel of these molars is of a greenish-grey colour, which in the neighbourhood of the roots acquires a darker and bluish tint.

I will not take up the time of the Society by repeating the detailed description, which I give in the memoir of which the present communication is only a summary. I shall content myself with saying that the form of the teeth and their mode of wearing leave no doubt that they have belonged to a monkey of the genus *Macacus*, nearly allied to the *M.* (*Inuus*) *ecaudatus*, which now inhabits the coast of Morocco and the Rock of Gibraltar.

I am led to assume for the *M. priscus* of Montpellier a size rather superior to the fossil before us, having measured the three true molars of a living species of *Macacus*, in which the length of the lower teeth corresponds with the figure given by M. Gervais for the Montpellier fossil. Nevertheless it is well known that differences of size are often considerable in the different individuals of the same species of Quadrumana, and especially as regards the Macaques. The figure given of the specimens referred to *M. priscus* is not sufficiently accurate to allow of the discussion of the possible differences of the two specimens; and, taking all this into consideration, I prefer retaining, at least for the present, the designation *M. priscus* for the fossil of the Val d'Arno: fresh specimens will perhaps hereafter give rise to a new name, which I cannot justify at the present moment.

Every thing leads us to believe that we shall not have to wait long for fresh evidence. During my visit to Florence M. Cocchi was kind enough to show me a fine mandible of a fossil monkey, which he ascribes to an *Inuus* (*Macacus*), and which had been found a few months ago near Monte Varchi, in the upper Val d'Arno. M. Cocchi has already spoken briefly upon this at the meeting of the Italian Society of Anthropology at Florence*.

The dental series of this fine specimen is tolerably complete; there are wanting only the right canine and three incisors. The enamel of the teeth presents absolutely the same shades of colour that I have indicated in the fossil from the Museum of Milan, which seems to show that the two specimens are derived from the same deposit. From a hasty examination I do not think that these two speeimens can be separated specifically. However, it is to M. Cocchi that it belongs to describe the mandible of the Florence Museum.

What is the relative age of these Macaques of the Val d'Arno? The locality "Val d'Arno" has long been with palæontologists synonymous with *Pliocene*. MM. Gaudin and Strozzi first commenced, by their "Contributions à la flore fossile Italienne"†, to disentangle the question of the relative age of these strata. Molars found by the Marquis Strozzi himself near San Giovanni are referred by him to *Mastodon angustidens*, Cuv., and *M. pyrenaicus*, Lartet. If this determination is correct [*], these two species incontestably indicate the presence of Miocene deposits in the Val d'Arno; and the study of the flora, which we here pass over, led to the same result. *Mast. angustidens* especially is eminently characteristic of the middle Miocene of France, Switzerland, Southern Germany, and Austria, such as Sansan in the Pyrenees, Käpfnach in the upper freshwater Molasse of Switzerland, Georgensgmund in Bavaria, Eibiswald in Styria, &c. It is not, therefore, as M. Stöhr thinks [†], to the Eppelsheim deposit that the blue marls in which these two species have been found correspond; at Eppelsheim only the *M. longirostris*, Kaup (which belongs to the subgenus *Tetralophodon*), has ever been met with.

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* Meeting of the 20th February of the present year. See the 'Nazione,' 27th February, 1872.

† Neue Denkschriften der allgem. schweizer. Gesellsch. für die ges. Naturwissensch. vol. xvii. 1860.

The numerous remains of Mammalia buried in the Val d'Arno, in the beds superior to those just mentioned, are referred to the Pliocene. Among those which have been well determined we may cite, above all, three species of *Rhinoceros*.

1. *Rhinoceros etruscus*, Falc., is frequent in the upper Val d'Arno, of which, according to Dr. Falconer, it characterizes the lower beds [‡]. In the preglacial forest-bed of Norfolk it occurs, together with eighteen well-defined mammals, taking no account of others, the determination of which is not certain. I will cite as examples:—*Rhinoceros leptorhinus*, Cuv., *Bos primigenius*, *Hippopotamus major*, *Elephas antiquus*, *Elephas meridionalis*, *Ursus arvernensis*, two species of *Cervus* now extinct, and *Trogontherium Cuvieri*, besides six still living species of mammals, namely *Mygale moschata*, *Talpa europæa*, *Cervus capreolus*, *Cervus elaphus*, *Arvicola amphibia*, and *Castor fiber* [§]. If *Rhinoceros etruscus* is really the same species as *R. Merckii*, Jæg., as Lartet [‖] and Boyd Dawkins [¶]

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[*] M. Cocchi does not mention these fossils in the enumeration which he gives of the fossils of the Val d'Arno:—"L'uomo fossile nell' Italia centrale," Memorie della Soc. Ital. di Sci. Nat. tomo ii. no. 7, 1867. At p. 15 we read as follows:—"If *Mast. arvernensis* probably did not share our soil with other congeners, this was not the case with the elephant," &c.

[†] "Intorno ai Depositi di Lignite che si trovano in Val d'Arno superiore, ed intorno alla loro posizione geologica," per Emilio Stöhr (Annuario della Soc. dei Naturalisti in Modena, anno v. 1870, p. 93).

[‡] Palæontological Memoirs, vol. ii. p. 310.

[§] Boyd Dawkins, "On the Distribution of the British Postglacial Mammals," Quart. Journ. Geol. Soc. vol. xxv. 1869, p. 210.

[‖] Ann. des Sci. Nat. vii. 1867, p. 27.

[¶] Quart. Journ. Geol. Soc. vol. xxvi. 1870, p. 468.

have supposed, it is met with in Switzerland, together with *Elephas antiquus*, *Bos primigenius*, *Cervus elaphus*, &c., in the foliated coals of Dürnten, which were preceded and succeeded by a glacial epoch[*]. In Germany *Rhinoceros Merckii* preceded *R. tichorhinus*, and, according to H. von Meyer, occupies the lower part of the Diluvian, whilst *R. tichorinus* occurs in the upper part, which, however, does not preclude that in some places the two species may have coexisted[†].

2. *Rhinoceros leptorhinus*, Cuv., the principal representative of which is the celebrated Cortesi skull preserved in the Museum of Milan, does not appear to be very frequent in the Val d'Arno. Falconer regarded this species as characteristic of the upper Pliocene formation of the Val d'Arno[‡]. In England, as we have already said, it was first met with in the Norfolk forest-bed. The lower brick-earths in the valley of the Thames, according to Mr. Boyd Dawkins, unite the preglacial to the postglacial—that is to say, to the fauna of the caves and fluviatile deposits[§]. We have already (p. 159, note) given the list of the mammals found in one of these localities (Gray's Thurrock); to this must be added, to complete the fauna of the brick-earths in general, the following Mammalia met with in other localities in the valley of the Thames:—*Cervus capreolus*, *Ovibos moschatus*, *Ursus ferox*, *Elephas primigenius*, *Rhinoceros tichorhinus*[||]. In these earths, therefore, *Rhinoceros leptorhinus* occurs associated with a partially arctic fauna. Moreover its presence has, not long since, been demonstrated by Mr. Busk in the Oreston cave[¶].

3. *Rhinoceros hemitœchus*, Falc., which has generally been regarded as characteristic of the epochs posterior to the two species already cited, but anterior to *R. tichorhinus*[**], has been met with in England in certain caves, together with

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[*] Heer, Urwelt der Schweiz, p. 498.

[†] H. von Meyer, "Die diluvialen *Rhinoceros*-Arten," Palæontographica, Bd. xi. 1864, p. 282.

[‡] Falconer, *l. c.* p. 310. "With this species [*R. leptorhinus*, Cuv.] also I have identified the rhinoceros remains found in the Subapennine beds of Piacenza, in the Val d'Arno upper beds, at Montpellier and Lyons, and at Gray's Thurrock in Essex."

[§] "On these grounds the deposits in question have been separated from the ordinary postglacial series. They probably form the first terms of the postglacial series, and point back to a time when the postglacial invaders had not taken full possession of this district" (W. Boyd Dawkins, "On the Distribution of the British Postglacial Mammals," Quart. Journ. Geol. Soc. vol. xxv. 1869, p. 214).

[||] Boyd Dawkins, *l. c.* p. 199.

[¶] Quart. Journ. Geol. Soc. vol. xxvi. 1870, p. 457.

[**] Boyd Dawkins, "On the Dentition of *Rhinoceros leptorhinus*, Owen," Quart. Journ. Geol. Soc. vol. xxiii. 1867, p. 213 *et seqq.*

Elephas antiquus and *Hippopotamus major.* We have already cited it among the Mammalia of the brick-earths of the valley of the Thames. In another cave it also occurs side by side with nearly all the species characteristic of the Pleistocene period in England, and especially with *R. tichorhinus* (Boyd Dawkins, *l. c.* p. 225). Finally, in a particular case, at Peckham, the remains of *R. tichorhinus* have been found in a peat-bed below the bed of clay which contained *R. hemitœchus.*

4. *Elephas meridionalis* occurs in England in the forest-bed, but does not appear to have in that country survived the glacial epoch[*]. In Lombardy it has been found in abundance in the lacustrine basin of Gandino, which M. Stoppani maintains to be of glacial origin[†], and the fauna of which is known to us by the work of M. Balsamo Crivelli, and especially of M. Cornalia[‡].

I might further name the *Hippopotamus major*, which is cited in the Pliocene fauna of the Val d'Arno, and which everywhere else occurs in indubitably quaternary deposits; but it seems to me that the identity of the species of the Val d'Arno with that which occurs so abundantly in the alluvia of rivers and in caves has not yet been satisfactorily demonstrated. Most of the other species buried in the rich ossuary of the Val d'Arno likewise require to be carefully studied.

Nevertheless the few examples which I have just cited appear to me to demonstrate satisfactorily that the proofs (if there are any) in support of the assertion that the beds in which these Mammalia occur belong to the Pliocene must be sought in the Val d'Arno itself; we must not, as has been done, call in the testimony of their places of deposition in other countries; for, as we have just seen, these furnish no evidence.

I will, however except a single species among those which are well-determined and called Pliocene of the Val d'Arno, namely *Mastodon arvernensis.* For France we have the testimony of two highly esteemed authorities, Lartet[§] and M. Gervais[||], that *Mastodon arvernensis* did not coexist with *Elephas meridionalis* (as had generally been supposed), but that the latter always occurs in more recent deposits. Moreover, of late, voices have been raised in England which admit that the same thing may be true for that country also*.

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[*] Nevertheless M. Gaudry, in his 'Considérations générales sur les animaux fossiles de Pikermi,' 1866, p. 38, cites *Elephas meridionalis* as occurring in the quaternary deposits of the valley of the Thames.

[†] A. Stoppani, 'Note ad un Corso annuale di Geologia,' 1867, part ii. p. 210.

[‡] E. Cornalia, 'Sull' Elefante trovato nella Lignite di Leffe,' Milan, 1865. Also "Mammifères fossiles de Lombardi," Milan, 1858–71, in the 'Paléontologie Lombarde' of A. Stoppani, 2^e série.

[§] Bull. Soc. Géol. France, 2^e sér. tom. xvi. 1859, p. 494.

[||] Zool. et Paléont. Franç.

As to the Val d'Arno, at present, incontestable evidence in support of the assertion that these two genera of Proboscidia coexisted is still wanting.

With regard to the *Macacus* of the Val d'Arno, I think I may assume that it was contemporary with *Rhinoceros etruscus*, *Elephas meridionalis*, *Bos etruscus*, Falc., and a horse which I cannot distinguish from *Equus fossilis*, Owen—at least as it is described by M. Rütimeyer, from the volcanic alluvia of Auvergne†. The same marly grit in which the fragment of the jaw of *Macacus* belonging to the Museum of Milan is imbedded covers and fills the remains of the above-cited Mammalia preserved in several museums.

Fossil Monkey from Monte Bamboli.—At the meeting of the Geological Society of France, in November 1871, M. Gervais mentioned a monkey found in the lignities of Monte Bamboli, in the Maremmas of Tuscany‡. The mandible in question is deposited in the Museum at Florence; according to M. Cocchi it seems to belong to the genus *Cercopithecus*§. We are expecting its publication by M. Gervais.

Fossil Monkey from Mugello.—Lastly there are in the Museum of Pisa some separate teeth of the lower jaw, a hasty examination of which seemed to me to indicate a species of *Macacus* which might be different from the two specimens from the Val d'Arno of which I have just been speaking; as to the determination of the genus there can be no doubt. These specimens consist of two last lower molars, right and left, a first or second lower molar, a premolar, and a fragment of a canine, the whole having probably belonged to the mandible of the same individual. These teeth are derived from Mugello, in the Val d'Arno, from a lignite that M. Meneghini considers to belong to the Pliocene. By M. Meneghini's permission I shall shortly be able to give a detailed description of these remains in the Memoirs of the Society.

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* E. Ray Lankester, "Contributions to a knowledge of the newer Tertiaries of Suffolk and their Fauna," Quart. Journ. Geol. Soc. vol. xxvi. 1870, p. 498.

† L. Rütimeyer, "Beiträge zur Kenntniss der fossilen Pferde und zu einer vergleichenden Odontographie der Hufthiere im Allgemeinen," p. 91 (Verhandl. der Naturforsch. Gesellsch. in Basel, Bd. iii. Heft 4, 1863).

‡ See 'Revue Scientifique,' No. 25, Dec. 16, 1871.

§ See 'La Nazione di Firenze,' February 27, 1872.

XXIV.—*On* Flustra marginata *of Krauss and an allied Species, forming a new Genus* (Flustramorpha) *of* Escharidæ, *from Natal.* By Dr. J. E. Gray, F.R.S. &c.

In the collection of corallines containing a few seaweeds, especially the one described in the August number of the 'Annals,' received some years ago from Port Natal as a present from Colonel Bolton, I observe several specimens of the *Flustra marginata* described by Dr. Krauss in his 'Corallines and Zoophytes of the South Sea,' p. 35, tab. 1. fig. 3. The figure of this coralline has always been a matter of curiosity to me; and therefore it was with great pleasure that I found several specimens of this and an allied species in the collection. Their formations are very peculiar, having the frond-like form of a *Flustra*, but supported by horny, often inosculating fibres, that margin the frond and also traverse it in various directions so as to break it into several sections, as is well represented in Krauss's figure. One might be inclined, as it often grows among the dead denuded stems of zoophytes, to believe that those zoophytes formed the margin of the frond; but a study of numerous specimens has convinced me that this cannot be the case; for the thickened horny margins do not stand out from the ends of the fronds, as they would do if they were the denuded stems of other species, but they are evidently developed on the edge and across the frond as the frond grows.

The substance of the coral is calcareous and exactly like those of *Lepralia* and *Eschara*; and it forms a frond with a series of cells on each side like the latter genus. The fronds are expanded, repeatedly and furcately branched like the common *Flustra*, but they are known from that genus by the cells being much more calcareous and covered with a calcareous coat. The two species have a general external resemblance to the two common European Flustras *F. foliacea* and *F. truncata*; I therefore propose to call the genus *Flustramorpha.*

Krauss, when describing *Flustra marginata*, observes that "perhaps it may become the type of a separate genus on account of the thickened edges, which, standing out from the calcareous structure, border the two margins of the frond. Where the frond divides, the thickened edge of the upper margin turns across it; and consequently it appears that the growth of the branch is continuous; but here a pause occurs, during which the thickened margin is forming, which after a time constitutes the foundation of a new lobe. These cross lines show the different epochs of growth, like the varices on *Murices* and *Cassidæ* and other genera of shells.

"These thickened ribs give the strength and firmness which are necessary to support the extremely fine and brittle cell-structure of the frond. The whole zoophyte can therefore only be dried and preserved with great care; but if it dies in the sea the calcareous matter soon after death dissolves in the sea-water, and, instead of the stiff light bluish grey-brown zoophyte, one only finds a pale brown, horny, shining skeleton with more transparent cells; a similar skeleton may be obtained by placing a frond in very weak acid. The ribs of the frond are then visible; and one recognizes on these teeth the points by which the bordering seam is connected with it."

Dr. Krauss describes both sides of the frond as covered with blunt rhomboidal cells; "at the upper end of each cell is a rounded, four-cornered, untoothed, oblique oral opening, and on the side of the opening there is a small circular anal aperture. This second opening is always directed sideways towards the edge of the frond; that is to say, if a perpendicular line is drawn from the middle of the frond, it is found to be on the right side of the line on the right side, and on the left of it on the left side of the oral aperture. Immediately below the oral aperture is to be observed a second, very small opening, the use of which is not known." Similar openings are to be seen in several species of *Lepralia*.

It is curious that Dr. Krauss, who observes so accurately the structure of the cell, did not see that the coralline was much more closely allied to *Eschara* and *Lepralia* than to *Flustra*.

The other species is perhaps described by Mr. Busk as *Eschara*; but he does not mention the margin or divisions.

Fam. **Escharidæ.**

Genus FLUSTRAMORPHA.

Polyzoarium frondose, flabellate, furcately divided; cells disposed on both surfaces back to back, immersed, coalescent, parallel to the plane of the axis. Oral opening with a small tubular opening on one side of it and a smaller aperture beneath. The frond supported by cylindrical horny fibres, which traverse it in various directions and edge the two margins of the lobes.

1. *Flustramorpha marginata.* B.M.

The polyzoarium grey-brown, rather thin; the stem and branches strap-shaped, with nearly parallel sides, regularly furcately branched, and margined with a thickened rib.

Flustra marginata, Krauss, Beitr. Corall. und Zooph. der Südsee, 1837, p. 35, tab. 1. figs. 3 *a–d*.

Hab. Port Natal.

2. *Flustramorpha flabellaris.* B.M.

The polyzoarium pale reddish brown; the frond widening upwards, rather irregular; the terminal lobes broad, fan-shaped or irregular, much broader at the end.

Eschara flabellaris, Busk, Cat. of Marine Polyzoa, ii. p. 91, tab. 107. figs. 7, 8, 9, 10.

Hab. Port Natal.

This species much resembles *Flustra marginata* in external appearance, but is much more calcareous and supported by marginal and transverse horny ribs, which are stouter but do not form such a regular margin to the frond as in the other species; and the frond is broader, and more irregularly divided, the terminal lobes being very irregular in shape, very unlike the regular strap-shaped furcate fronds of the former species.

Mr. Busk, to whom I had sent a small specimen of this species, informs me that it is the one he described and figured in the 'Catalogue of Marine Polyzoa' under the name of *Eschara flabellaris*; but in neither the figure nor description is there any mention of the lobes being divided and supported by a cartilaginous margin; in other respects the figure is a very good representation.

XXV.—*A Cuvierian Principle in Palæontology, tested by evidences of an extinct Leonine Marsupial* (Thylacoleo carnifex), *by* Professor OWEN, F.R.S., D.C.L., Foreign Associate of the Institute of France. Reviewed by GERARD KREFFT, F.L.S., C.M.Z.S., M.F.D.H., &c.*

[Plates XI. & XII.]

PROFESSOR Owen spoke boldly when he thus headed his last treatise on the Extinct Mammals of Australia,—too boldly, in fact—because if the "Cuvierian Principle in Palæontology" is once found wanting, it must be reduced in value ever afterwards. The founder of a science is not always able to provide at first for all the exigencies which may arise out of a careful investigation of his system; and the worship of learned men may go a little too far. It is right to love the master who taught us, and I admire Professor Owen on that account; but when anatomists like Flower, Falconer, and Huxley differ from Cuvier as they differ from Buffon and Linnæus, Professor Owen will probably reconsider his verdict and make the *amende honorable.* Cuvier and his principles cannot always be depended on in the classification of Australian fossils; and

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* From the 'Sydney Mail,' May 18, 1872, with corrections and the illustrations communicated by the Author.

I refer those interested to Sir Thomas Mitchell's 'Three Expeditions,' where, on plate 32 of vol. ii., the author remarks, "The two figures 12 and 13 represent, on a reduced scale, the large bone which M. Cuvier supposed to have belonged to a young elephant."

It was evidently M. Cuvier who could not distinguish between the femur of a "gigantic kangaroo" and that of an elephant; and we are justified in discarding Cuvierian principles as far as fossil marsupials are concerned.

Professor Owen may say that the bone figured by Sir Thomas Mitchell is *not* a kangaroo-bone; but it never was the femur of an elephant, and if not a kangaroo it certainly belongs to a marsupial animal closely allied to it. All the other objects represented on the same plate are either wrongly named or not named at all. Did M. Cuvier inspect these bones also? Did Professor Owen notice what they really are? Fig. 1 is the ulna of a wombat; fig. 2 a block of limestone nodules with a few wombat-phalanges (toe-bones) in it; fig. 3 is a much-worn lower incisor of a gigantic kangaroo; figs. 4 and 5 are two views of a right upper first incisor of a *Thylacoleo*; figs. 6, 7, 8, and 9 are different views of the right lower incisor of *Thylacoleo*; fig. 10 represents the much-worn right third premolar of a *Thylacoleo*, the very tooth which the author of the "extinct leonine marsupial" constantly terms the great carnassial, and which was of so little importance to him in 1836 that he never referred to it in his report on the Wellington fossils.

If these teeth did not strike Professor Owen in 1836 as uncommon, why are they considered valuable evidence of carnivority in 1858 or 1859? In that year I think the first attempt was made to fit some fragments of a *Thylacoleo*'s skull into such a shape as to produce a cat-like head ('Cyclopædia Britannica,' art. Palæontology, p. 175, fig. 115). Let any unprejudiced person examine the impossible restoration of that head (Pl. XI. fig. 4), and he will at once see that the author had a preconceived opinion about it, evidently trying to form the remains into the skull of a carnivore.

I consider these remarks necessary before reviewing Professor Owen's paper; and they will show:—1st, that the chief part of the *Thylacoleo*'s dentition was known to him as far back as the year 1836; 2nd, that there was nothing very extraordinary in the size or formation of the teeth, otherwise Professor Owen would have noticed them long before; 3rd, that, having once pronounced a certain opinion, the author has been reluctant ever since to modify or alter it; 4th, and last, that the principle in palæontology laid down by the great

Cuvier cannot be applied with confidence or successfully in the classification of our fossil marsupial animals, which were not discovered when Cuvier wrote.

The authorities against Professor Owen are Professor Flower, F.R.S., the eminent lecturer at the Royal College of Surgeons, the late Dr. Falconer, Mr. Boyd Dawkins, and the discoverer of the missing teeth, who first pointed out their real position in skull and mandible, myself.

It is a well-known fact that in highly carnivorous animals the exposed portion of a tooth is completely covered by enamel. This is not the case with the *Thylacoleo*'s incisors, which Professor Owen considers designed to "pierce, retain, and kill"! They are almost destitute of enamel on their flat inner surface, and are, comparatively speaking, less formidable than the upper and lower front incisors of the striped phalanger known as *Dactylopsila trivirgata* (Pl. XI. figs. 6 & 7), the nearest ally (as far as incisors are concerned) to the *Thylacoleo*.

The corresponding pair of front teeth in the *Belidæus flaviventer*, or "yellow-bellied flying squirrel," are more like the *Thylacoleo*'s teeth in their structure; but they are not so largely developed as the teeth of the *Dactylopsila*, which, comparatively speaking, has the largest incisors of any marsupial animal living or extinct, though only a fruit- and leaf-eating phalanger.

The dental formula in *Thylacoleo* is as follows:—

Incisors.	Canines.	Premolars.	Molars.	
$\frac{6}{2}$	$\frac{1-1}{0-0}$	$\frac{3-3}{3-3}$	$\frac{1-1}{2-2}$	} 28.

Professor Owen, to suit his peculiar system, arranges these teeth in this manner:—

Incisors.	Canines.	Premolars.	Molars.	
$\frac{2-2}{1-1}$	$\frac{1-1}{0-0}$	$\frac{4-4}{4-4}$	$\frac{1-1}{2-2}$	} 30[*].

If the author will kindly examine the upper incisors of a common bettong (*Bettongia rufescens*, Pl. XI. fig. 8) and compare therewith the *Thylacoleo* incisors which I sent him, and which he figures under wrong names, he will at once perceive that the "leonine marsupial" had a large pair of front incisors (which correspond, as before stated, with those of *Dactylopsila* or *Belidæus*), and a second and third pair behind the first, which are almost identical in form with those of the bettong just mentioned. The first tooth in each upper ramus is curved, compressed, and almost destitute of enamel on the inner side; the second tooth is conical, with a short thick produced crown, showing a transverse mark made by the lower incisor; the third tooth, again, is curved, three-sided, and inserted in such a manner that the sharp angle stands inwards. Professor Owen, disregarding my careful investigations, freely communicated to him, figures it constantly as a "canine" (pl. xi. figs. 10, 11, and 12). The conical second incisor (fig. 13 of the same plate) he names the "first upper premolar, outer side," though he figures the small tubercular premolars with their nail-headed crowns (pl. xi. fig. 2, pp. 2, 3) right enough.

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[*] The two or three little teeth which occupied the empty sockets behind the anterior part of the third incisor are still unknown; we do not even know whether they were two or three in number. These teeth are met with in all phalangers proper, but are seldom found perfect.

The upper canine puzzles Professor Owen considerably, as it did myself when I first found loose specimens of it. This tooth, which encroaches further into the palate than is usual (and is sometimes almost covered by the first premolar and last incisor), has a curved tapering fang and a heart-shaped flattened crown. Mistrusting my observation, the author again calls it "the second incisor" in one instance, and "the second upper premolar" in another (figs. 9 and 14 of pl. xi.).

I make these statements with confidence, and will explain why.

Every tooth which Professor Owen figures on pl. xi., from no. 9 to 14, was collected by myself and transmitted to him, as my list and photographs will prove. These teeth are not from *a* breccia cave, but from "*the breccia cave of Wellington valley*," and they are what I stated them to be, and not what Professor Owen designates them in his treatise.

I have known the teeth for years to be those of *Thylacoleo*, and I reconstructed the skull with all the teeth in it in 1869 (Pl. XI. fig. 3). This plate, lithographed by Mrs. Forde, was printed at the Government Printing Office in 1870, with seventeen other plates of fossil remains (by Miss Scott and Mrs. Forde), which, however, for want of funds, have never been published. I was desired to give Professor Owen all the information I could; and I kept nothing back; but for some reason or other the most typical specimens, of which I could send *photographs only*, are not figured in his paper.

The illustration of a tooth (pl. xi. no. 6) named "crown of a less worn upper laniary, outer side," which means "a left first upper incisor," should have been drawn from the *inner side* as well, so as to show the absence of the enamel. Compared with Sir Thomas Mitchell's figure in the 'Three Expeditions' (fig. 5. pl. 32), the fallacy of Professor Owen's argument as to its laniary (*i. e.* flesh-cutting) character becomes at once apparent.

Professor Owen is careful to give us three views of a much fractured specimen of the right upper jaw from Queensland, in which the most interesting teeth (the second and third incisors) are missing, and the canine is fractured. He uselessly figures also a fractured mandible (pl. xiii. fig. 2), a more complete one having been given above it (fig. 1). He carefully avoids enlightening his readers by supplying a sketch of the upper teeth belonging to fig. 2, of which the canine and two hinder incisors were almost perfect; these teeth are figured exactly in the position in which they were found imbedded in stiff moist loam. Having unfortunately broken the skull and mandible into fragments with my pick, I called Dr. Thomson and Harry Barnes to my aid, and pointed out the position in which the teeth lay imbedded, asking friend Thomson to take notice of it, so that there should be no dispute about the matter hereafter. To myself the arrangement of the teeth was known from other specimens obtained on former occasions; but Dr. Thomson had never seen them together; and we both sketched their position.

There is nothing wrong in the arrangement of the teeth in the rejected photograph, except that the sharp edge of the third incisor should be more inward, and the canine should, of course, be partly hidden by the third incisor and the first small premolar. We had just removed the teeth, when Harry Barnes blew the candle out to prevent some uninvited visitors from coming down the shaft. These inquisitive "gentlemen" were too far, however, for retreat, and, bewildered by the sudden darkness, brought their bodies and some ten tons of loose breccia on the top of our "diggings," and so prevented us from finding the rest of the skull. Professor Owen's left incisor (no. 6 of plate xi.) looks very much like the fellow to my right-hand one. Having carefully removed the dirt and the "dirty visitors" I had another examination of the moist clay, and found the condyle, which resembles that of a koala or native bear*.

It is necessary to go thus into particulars; and as Professor Owen will not believe me, I must speak out myself. Twisting or turning will not alter what I stated to be the truth; and I feel confident that time and Professor Flower will prove the correctness of my observations.

I have been in the habit of consulting Professor Owen's works on our marsupials, and I have always found he has given it as his opinion that the first tubercular tooth behind the lower incisor of a phalanger must be considered to represent the canine. As late as the year 1868 he teaches this; and he gives examples of such teeth in the 'Anatomy of Vertebrates,' vol. iii. p. 289, figs. 228 and 229: the last represents the dentition of *Phalangista Cookii* (our "red ringtail opossum"). In this figure the large incisor is the first tooth of the series, then follow three small tubercular teeth, the first of which is distinctly marked "canine."

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* A cast of a similar condyle, with a portion of the inflected angle, was dispatched to Professor Owen as far back as 1863 or 1864. A year or two afterwards I pointed out that the cast sent *must be* that of the missing part of the *Thylacoleo's* mandible. I had good proof of my assertion; but the proposition was not entertained by Professor Owen.

It has been proved that all phalangers proper have three premolars above and below at some time or other of their existence; but in the face of this evidence laid down by Professor Owen, as well as by Flower and others, the great anatomist now turns these three little teeth into "premolars," and alters the premolar formula of *Phalangista* to *four* below, whilst he retains only three above. (See 'A Cuvierian Principle &c.' p. 254, fig. 19, right mandible of *Phalangista Cookii* with four premolars, and without a canine.)

I make no comments on this strange alteration to suit a certain purpose, which, if accepted by anatomists, will confuse every thing Professor Owen has taught about the dentition of the genus *Phalangista*. The first tooth after the incisor in the mandible of a phalanger is most undoubtedly a canine, and it will remain a canine as long as there is truth in comparative anatomy. Even if every other tooth is marked with a "p" (premolar), it will never be believed by those who understand these things, and the teeth will be called, as hitherto, by their right names given by Professor Owen himself. If we examine the depressions, two or three in number, on the front inner side of the large premolar of *Thylacoleo*, it will be observed at once that they probably contained two or three little teeth, like other phalangers, the first of which would of course represent the lower canine.

Thus far the herbivorous principle is prevalent; but with the true molars reduced to a pair below, one of which is tubercular, and to a single transverse tooth above, the somewhat carnivorous character of the animal becomes manifest. The carnivority is still further expressed in the position of the line of mandibular teeth, which exactly fronts the ascending ramus; but there, again, the carnivorous proof ends.

From the shape of the condyle, placed moderately high, and from the broad, scoop-like inward process of the lower jaw, we conclude the *Thylacoleo* to have been a mixed-feeding or herbivorous animal.

On page 236 of the treatise 'A Cuvierian Principle in Palæontology,' we read in plain words, "The rotatory grinding-movements of the mandible are commonly associated with a high position of the condyle and vegetable diet; the vertical biting-movements are commonly associated with a low position of the condyle and animal diet." This is not quite correct, the condyle of the herbivorous phalanger known as *Dactylopsila trivirgata* being lower than the row of grinding teeth.

On April 19, 1870, I wrote to Professor Owen, saying, "The carnivorous character of our friend *Thylacoleo* is greater than I first thought it was. I firmly believe the cast of a condyle I sent you is that of this animal." These remarks were made when I had noticed the row of teeth to be in a line with the ascending ramus, which is a more or less carnivorous character in marsupials.

June 13, 1871 (evidently too late for the paper under discussion), I wrote again:—"Regarding the *Thylacoleo* I wish to assist you as much as possible to arrive at a correct determination of the animal's character. I sent you already what I consider the condyle and angular process, in fact the very part which is missing. *If you choose to believe me*, it is the identical left posterior portion of the jaw, whereof we possess the right anterior one also. The jaw is very much like that of a koala; and the condyle resembles it more than that of any other animal." With this letter I despatched a series of careful tracings of my sketches, including one of an upper canine of a tiger and the lower incisor of a *Thylacoleo*, for comparison.

Nearly a year has passed since this letter was written; and my opinion that the animal under discussion is a mixed feeder, allied to the phalanger tribe, is more and more confirmed. There is no occasion for me to fall back upon the Purbeck fossils, or to ransack all the countries under the sun for allied forms; I have only to examine the numerous recent skulls of *our* marsupials collected for a purpose like the present during the last twelve years, and I am *able* to form a very good idea of the "leonine marsupial."

I believe, and am ready to prove presently, that the *Thylacoleo* contained in its structure certain characteristic parts from each of our principal marsupial groups. Let me describe the upper jaw:—The first pair of curved incisors (Pl. XI. fig. 2, and Pl. XII. fig. 1, *a*) resemble those of the *Belidæus flaviventer* or "yellow-bellied flying phalanger." The next pair (*b*), as well as the third (*c*), are as near in shape to those of the "bettong" as can possibly be imagined. The canine (*d*), with its compressed crown, is also "bettong-like," and differs considerably from that of the phalangers proper. The disposition of the incisor teeth is the same as in the "bettong" (Pl. XI. fig. 8), the curved first incisor arching above the close-packed second and third one. All these teeth vary considerably, and indicate several distinct species; the canines are as irregular in their structure, and lead to the same conclusion. The short functionless first and second premolars (*e*, *f*) do not indicate great carnivorous propensities, and they are not near so formidable-looking as those of our phalangers.

I mentioned before that the upper canine stands far back into the palate, and is often completely covered by its neighbours. With regard to the third premolar (*g*), Owen's "carnassial tooth," it will be found, in form, position, and function, to be identical with the third premolar in the common *Phalangista vulpina*, in *Cuscus maculatus*, and in other more or less carnivorous phalangers. This tooth is often worn in a far greater degree than Professor Owen imagines; and specimens now in his hands will sufficiently prove it. No "formidable carnivore" would be able to make an impression on "hide and flesh" with such "grindstones:" I have no more appropriate word to offer when describing the worn condition of some of the many specimens examined by me. The upper first and only molar (Pl. XII. fig. 20) is a shallow-rooted, distorted, flat, rugged tooth, with a depression in the middle, and evidently designed for grinding or crushing, never for lacerating flesh.

Looking at Professor Owen's figure on plate xiv. (Phil. Trans. 1871), I notice the old tendency to make the animal as carnivorous as possible. The first upper incisor has the form of a "parrot's beak," and is probably *not* quite true to nature; the indicated second incisor is far too small; and the tooth which he terms a "canine" is out of shape and out of place where Professor Owen has put it. The upper front teeth of a *Thylacoleo* are closely packed, there is not a line of space between them; the canine is perfectly crowded out, and stands back into the palate, as Professor Owen's drawing plainly shows; but he will call this real undoubted "canine" the "first premolar," and I shall say no more.

Description of the lower jaw (Pl. XI. fig. 1):—This part settles all our disputed points, and turns the supposed "lion" into a leaf-eating phalanger. The front view of it, given on plate xiii. fig. 3, is too broad; the incisors should not close together at the tip, but remain considerably parted, as their marks against the second pair of premolars clearly indicate. Professor Owen says, to illustrate the power of these weak incisors (p. 228):—"Were a pair of bayonets cemented side by side, and the force of two brawny arms concentrated on the thrust, their perforating and lethal power would be increased." The Professor is right enough in his conclusion; but his premises are wrong. The flat lower incisor teeth of our animal (Pl. XI. fig. 1, *a*, fig. 2, *h*, and Pl. XII. fig. 1, *h*) are *not* cemented close together; on the contrary, their attachment is remarkably weak; and the symphysis of the mandibles is *not* firm and compact like that of a koala or a wombat. We find plenty of wombat-jaws in a fossil state with both incisors present; even perfect jaws are not uncommon; and wombat-jaws, as a rule, seldom part at the symphysis: but not a single *Thylacoleo* jaw has ever been found under such conditions. The wombat is the only marsupial animal which in compactness, shape, and biting-power can at all be compared with our "lionized friend;" and the "formidable carnivore" was only as large again as a common wombat. We know fossil wombats considerably larger than the *Thylacoleo*; and having experienced the impressions of the teeth of some recent ones, I make confession that they bruised the part nipped considerably, but did not draw much blood; they crush, but do not tear. The koala bites sharper, and resembles the *Thylacoleo* more; but, like the wombat and unlike the "marsupial lion," it has much firmer jaws, and, were it as large as the *Thylacoleo*, would be more formidable. The average form of a koala's lower incisors differs considerably from the *blunt* specimens specially selected by Professor Owen, probably for other than Australian readers, and figured on page 233, no. 6, of his treatise. The real carnivorous marsupials have always a series of small incisor teeth inserted between the canines, which resemble those of ordinary placental carnivores. The most formidable, the Thylacine, or Tasmanian tiger, and the black Dasyure, were numerous in Postpliocene times; and that they did their duty well in checking the increase of the great herbivores (which were "calves" at some time of their existence) is evident enough from the marks which their strong teeth left on some of the fossil bones. Animals with *Thylacoleo*-dentition could not make such impressions.

If dingoes find no difficulty in destroying cattle, the great Dasyures were as able to overpower Diprotodons of respectable size; so that the *Thylacoleo* was not *required* for that purpose. But I am not going to speculate.

The general form of the lower jaw of our marsupial friend is undoubtedly that of a phalanger. The flattened and but partly enamelled lower incisors are exactly represented by the incisors of *Belidœus* and *Dactylopsila* (Pl. XI. fig. 7), even to their serrated edges; the diminutive canine and one or two premolars are the old story of the phalanger dentition over again; and the great third "carnassial" premolar (Pl. XI. fig. 1, *c*, fig. 2, and Pl. XII. fig. 1, *j*) resembles, as in the upper jaw, the outwardly produced formidable tooth of the common phalanger. No person who applied the laws of comparative anatomy correctly would fall into the mistake of supposing the *Thylacoleo*'s large premolar to be more closely related to that of the rat kangaroo than to the phalangers; and if I once mentioned *Thylacoleo carnifex* as a "gigantic kangaroo rat" in one of the Trustees' Annual Reports (as Professor Owen is careful to point out), I beg to assure him that this was done to give the general reader of such documents some idea of what was meant. I must try and speak in terms which the public can understand, and avoid as much as possible all *scientific names* for which English equivalents are at hand. The remaining teeth in the lower jaw are a triangular, posteriorly depressed molar (*d* and *k*), and a very small functionless tubercular tooth (*e* and *l*), which closes the series. The line of teeth is in a line with the rising ramus; and in this and in the form of the first molar I discern relationship with the *Dasyuridæ*. Several of the mandibles in the Museum collection show clearly, at the point where they are broken off, that the jaw widened out inwards and upwards like that of a wombat, to which, in this respect, the *Thylacoleo* was also related. The upward direction of the wombat's jaw from the base of the ascending ramus is very abrupt; and it may have been the same with the *Thylacoleo*. There is a foramen (small opening) at the base of the ramus, which also occurs in the wombat and koala and in all the kangaroos in a larger degree, but is never found in a true marsupial carnivore. The articulating condyle is irregular, large, rugged, and rounded; it resembles the condyle of the native bear or koala, and will be found (when discovered *attached to a perfect ramus*) to be a moderately high-placed condyle associated with the rotatory movements of the jaw, just as in herbivorous marsupials and herbivorous placentals (see Owen's 'Cuvierian Principle,' p. 233). I do not see the use of discussing the arguments of Professor Owen in favour of the existence of a "leonine marsupial" any further; I only remind him of the fact that our really carnivorous marsupials, from the smallest *Antechinus* to the largest Thylacine, resemble each other—that all have six lower incisors like the placental carnivores, "which hold the canines well apart," and strengthen them for the purpose for which they were designed—that all possess a low condyle, and always a sharp-pointed (never a broad and rounded) inflected angle below it. In not one of them has a foramen been noticed at the base of the *coronoid*; and all have rounded strong canines, which, in particular the upper ones, are covered with thick enamel; whilst the teeth of the *Thylacoleo* are compressed, and the upper incisors possess little or no enamel on the inner and lower surface. The true carnivorous type is always the same, whether we consider the placental or the marsupial orders. There is no more difference between a small marten cat and a tiger than there is between the minute *Antechinus* and the largest Thylacine; teeth and jaw are constructed on the same principle; and no teacher knows this better than Professor Owen.

But the *Thylacoleo* stands not isolated. I can prove several distinct species; and I have already discovered a much smaller allied form, described under the generic term of *Plectodon*. Of this genus I can also demonstrate three species at least.

On the 2nd April, 1870, I dispatched, by direction of the Trustees, two cases of specimens (2100 in number) to Professor Owen, no. 846 of which was the right lower incisor of a *Plectodon*. Professor Owen never mentions this, the most interesting specimen in the whole series, though it bears considerably on the question at issue, and I doubt not we shall hear of it at some future time. I kept photographs of it to prove its identity with my duly established genus *Plectodon*; whenever this becomes necessary.

I must bring my remarks to a close, however, though there are numerous errors yet to be corrected.

Making every allowance for Professor Owen's want of specimens, I am surprised to read the following sentence (p. 243): —"In the *Bettongia penicillata*, with such worn incisors, and with all the molars in place and showing an habitual use, the trenchant premolar retains its vertical groovings to the cutting-edge of both the outer and inner sides. They have been used to divide the grass-blades and leaf-stalk or other tough part or fibre of the vegetable food; but the more important and continuous work of mastication has had grinders in number, size, massiveness, and complexity of horizontal area fitted to perform it. Old age is attended with seeming exceptions to this rule in both human incisors and hypsiprymnal premolars, which then show the wear or work of life."

I draw the attention of Australians to table case A, section 4, in the new wing of the Museum, where "hypsiprymnal" and "bettongial" (fossil and recent) premolars may be seen, in which not only the premolars, *but the following three molars*, are worn "*Thylacoleo* fashion," leaving not a vestige of the vertical grooves.

Much-worn human incisors are by no means rare in the skulls of our collection; and in a particular one, found at Bondi, all the teeth are ground down to the roots. This remarkable wear is caused by the chewing of certain reed or bulrush-roots (*Typha Shuttleworthii*), for the purpose of getting at the starch between the fibres and to obtain the fibre itself, which, spun or twisted, was used by the aborigines to prepare fishing-, duck-, and wallaby-nets.

I can guess pretty well the age of native skulls, often brought here, by examination of the teeth, because the practice of chewing typha-fibre has ceased with the introduction of twine. I may have misunderstood Professor Owen regarding the wear and tear of incisor teeth; if he means to say that they *do wear* with age my remarks are superfluous. I regret that Professor Owen has so little faith in my observing-power, and more so that it is so difficult to convince him of his errors. I have explained to him, by way of long letters, photographs, casts, and original specimens, that the genus *Zygomaturus*, established by the late Mr. W. S. Macleay, must be retained, because the mandibular teeth of the animal which he has named *Nototherium* are totally different in shape and structure from those of Mr. Macleay's creature. Those who are able to do so may compare them (Cat. Royal Coll. Surgeons, Mamm. & Aves, plate 8. fig. 5, *Nototherium*, and Proc. Geol. Soc. vol. xv. plate 7. fig. 1). Professor Owen again and again refers to Mr. Macleay's genus under the designation of *Nototherium*; and as my own generic and specific terms have been superseded, sometimes in the most off-hand manner, by badly informed naturalists, I consider it my duty to keep facts such as these before the public. Professor Owen says (p. 263):—"No evidence of a megatheroid or other edentate animal has been had from any cave or fossiliferous deposit in Australia. The ungual phalanges (plate 13. figs. 11, 12, 13, 14) are too small for *Nototherium* and *Diprotodon*, if even one were to entertain the idea of those huge marsupial Herbivora having had sheathed, compressed, decurved, pointed claws like those which the phalanges in question plainly bore. These phalanges are much too large for the *Thylacinus* and *Sarcophilus*. But there is no other associated carnivore corresponding in size with that of the animal indicated by them save the *Thylacoleo*."

When sending the photographs and casts of these "claw-bones," I said to Professor Thomson:—"We shall have some fun, depend upon it; Owen will claim them as '*Thylacoleo*-claws,' just as he claims Macleay's *Zygomaturus* to be the part to which the *Nototherium*'s mandibles belong." Good, clever, liberal, and obliging Professor Thomson is gone to his long home, and Professor Owen has not disappointed my expectations.

The claw to which I more particularly refer as being that of a "megatheroid animal," and which, with its next joint, is deposited in the Australian Museum, where it may be inspected (table case C), is what I stated it to be—"the ungual or terminal phalanx of a creature allied to the *Mylodon*." The upper face of the sheath is naturally open; and the next joint is short and thick, like some of the phalanges of Professor Owen's *Mylodon* (see 'Memoir of *Mylodon*,' plates 15 and 16).

I am not going to try and prove what this claw is *not* like, as Professor Owen does. I only draw attention to the probability that there were in olden times, as at the present day, small Edentata as well as large ones; and as I first discovered the presence of fossil edentate Monotremes in this country, I may be allowed to say, with the evidence before me, that animals allied to the *Mylodon* will yet be found. I am very careful in my statements: I respect Professor Owen, and am ready to serve him at any time, whatever difference there may be in our opinions. I have cast my lot with Australians these twenty years; I have had opportunities like few persons living to study our fauna, and will not give in, because it must be proved first that I am wrong. I shall always strive to deserve the high compliment which Professor Owen, as well as Professor Flower, have paid me regarding my ability as the Curator of the Australian Museum; and I hope that, like the tattoo-marks in "Tichborne *v.* Lushington," my postscript will settle the disputed point.

POSTSCRIPT.—In drawing a few of the lower incisors of "*Thylacoleo*" last night for the purpose of giving illustrations of them in a future issue of the 'Sydney Mail,' I noticed, to my astonishment, clear evidence of attrition on the inner side of several. There was no doubt about it, they had touched each other during the lifetime of the animal (as kangaroo-teeth do), but generally at the tip only. In one specimen, however, the surface of the inner side was observed to be quite smooth to the extent of *one inch* on the lower margin. The ridge so prominent in young or immature specimens had totally disappeared, and my supposition that the jaws were loosely attached is clearly borne out. Professor Owen lays great stress on the sharp points of all the lower incisor teeth found in a perfect state; and as he makes this an argument in favour of the carnivority of our now "unmasked" friend, I may as well state why the teeth are not worn down. Every one of our *upper* incisors of *Thylacoleo* has the under surface, against which the lower teeth work, scooped out; and even in young animals the teeth-marks are plainly visible, and not a vestige of enamel can be seen. Is it a wonder that the lower incisor teeth keep perfect so long as they are not violently broken off? and will Professor Owen continue to call this probably handsome and certainly harmless creature, with "trembling jaws," the fellest of savage carnivores? How bears "the Cuvierian principle" an ordeal with animals which Cuvier did not know and did not dream of? The test has been applied, and human vanity is exposed again.

Sydney, May 15th, 1872.

EXPLANATION OF THE PLATES.

Plate XI.

Fig. 1. Lower jaw of *Thylacoleo*, showing the position of the broken ramus and coronoid process, restored from fragments in the Australian Museum at Sydney: *a*, incisors; *b*, two or three tubercular teeth, representing canine and first and second premolars; *c*, third premolar; *d*, first molar; *e*, second molar; *f*, base of fractured ascending ramus and coronoid process.

Fig. 2. Skull of *Thylacoleo* from the side, restored: *a*, first, *b*, second, *c*, third upper incisor; *d*, upper canine; *e*, first, *f*, second, *g*, third upper premolar; *h*, lower incisor; *i*, two or three tubercular teeth representing canine and premolars; *j*, third lower premolar; *k*, first, *l*, second lower molar; *m*, inflected angle of lower jaw; *n*, condyle.

Fig. 3. Skull of *Thylacoleo* as restored by Krefft in 1869.

Fig. 4. Skull of *Thylacoleo* as restored by Prof. Owen in the Encycl. Brit. vol. xvii. p. 175 (1859).

Fig. 5. Lower jaw of *Cuscus maculatus*, showing close relationship to *Thylacoleo*.

Figs. 6, 7. The skull and lower jaw of *Dactylopsila trivirgata*, to show the powerful incisor teeth of a vegetable- or mixed-feeding phalanger.

Fig. 8. Canine and upper front teeth of *Bettongia rufescens*: *a*, first incisor; *b*, canine.

⁂ All, except fig. 8, reduced about one half.

Plate XII.

Fig. 1. The dentition of *Thylacoleo*, reduced about one half. The letters as in Pl. XI. fig. 2.

Fig. 2. Left lower incisor, showing the extent of the enamelled portion.

Fig. 3. Right lower incisor, outer surface.

Fig. 4. First right upper incisor: *a*, inner, and *b*, outer view, showing the extent of the enamelled part.

Fig. 5. First left upper incisor, inner view.

Fig. 6. First right upper incisor, two views, from Sir T. Mitchell's 'Three Expeditions,' 1836.

Fig. 7. Right lower incisor, with fractured crown, from Sir T. Mitchell, 1836.

Fig. 8. Left lower incisor of a young *Thylacoleo*.

Figs. 9, 10. Second upper incisors.

Fig. 11. Right upper canine of a new species of *Thylacoleo*.

Fig. 12. Fractured upper canine.

Figs. 13, 14. Upper canines.

Figs. 15–18. Four premolars.

Fig. 19. Right lower third premolar, much worn, from Sir T. Mitchell, 1836.

Fig. 20. Upper molar, right side.

Fig. 21. Upper canine of a tiger.

XXVI.—*Description of two new Fishes from Tasmania.*

By Dr. A. Günther.

In a collection of Tasmanian fishes presented by Morton Allport, Esq., to the British Museum, two fishes were contained which appear to have hitherto escaped observation.

Lanioperca, g. n.

This genus would appear to be allied to the Percoid group of *Apogonina*, and more especially to *Scombrops*, as far as we are able to judge from external characters.

Body compressed, rather elongate, covered with thin deciduous scales of moderate size. Head with the snout produced and pointed, entirely covered with small scales. Cleft of the mouth wide, with the lower jaw projecting. Jaws, vomer, and palatine bones with narrow bands of villiform teeth, and with an outer series of stronger teeth. A pair of very strong canine teeth in the upper jaw. Tongue smooth. Eye of moderate size. Branchiostegals seven; pseudobranchiæ. Two dorsal fins, the first composed of a few feeble spines; the soft dorsal and anal with rather numerous rays; the latter with two spines. No denticulations on the cranial bones, the opercular margins being very thin and membranaceous.

Lanioperca mordax.

D. 5 | $\frac{1}{19}$. A. $\frac{2}{25}$. L. lat. 66.

The height of the body is contained five times in the total length (without caudal); the length of the head thrice and one fourth. The eye is nearer to the end of the opercle than to that of the snout, its diameter being two elevenths of the length of the head, and equal to the width of the interorbital space. The maxillary does not quite reach the vertical from the front margin of the eye, which is immediately below the upper profile. The teeth of the outer series in the upper jaw are subequal in size, and much smaller than those in the lower, the four or five posterior of which are enlarged, distant, and canine-like. Posterior margin of the præoperculum deeply emarginate. Pectoral fin not quite half as long as the head, the upper rays the longest; root of the ventral fins at a very short distance behind that of the pectorals. Dorsal spines very feeble. Caudal forked. Coloration uniform.

One specimen has been sent, 11 inches long. Mr. M. Allport says that it is of medium size and called "Pike" or "Jack" by the colonists.

Chilodactylus Allporti.

D. $\frac{17}{27}$. A. $\frac{3}{8-9}$. L. lat. 55–56.

Allied to *Chilodactylus nigricans*, but with the body more elevated and with the ventral fin reaching to or even slightly beyond the vent.

The height of the body is contained twice and a half or twice and two thirds in the total length. Six simple pectoral rays, the second of which is the longest, but projects only a little beyond the membrane. Dorsal spines strong, the fifth, sixth, and seventh being the longest, not quite one half of the length of the head. The spinous and soft dorsal fins of nearly equal height; but the last spines are much shorter than the first rays. Scales very rough. There are five longitudinal series of scales above the lateral line; and a band of minute scales runs along the base of the entire dorsal fin.

Purplish brown, with six broad, slightly oblique, blackish cross bands; fins and opercular membrane deep black.

Mr. Morton Allport has presented to the British Museum two specimens, 11 inches long; but the species grows to a much larger size, as we possess from another collection a third example which is two feet long.

XXVII.—*On the Nomenclature of the Foraminifera.* By W. K. Parker, F.R.S., and Prof. T. Rupert Jones, F.G.S.

Part XV. *The Species figured by Ehrenberg.*

[Continued from vol. ix. p. 303.]

XIV. *Foraminifera from the Chalk of the Isle of Möen, Denmark.* (Monatsberichte, 1838, p. 192; Abhandlungen, 1838, table III. pl. 4. fig. II.)

Pl. XXIX. figs. 1, *a*, *b*, *c*, *Rotalia laxa*, and fig. 2, *R. perforata*, must both be referred to the subdiscoidal variety of *Globigerina bulloides* known as *Gl. cretacea*, D'Orb. Figs. 3 to 7 are neatly grown, young or arrested *Planorbulinæ*, with globose chambers, comparable with the early stages of growth in *Pl. farcta*. They may for convenience be grouped as *Pl. globulosa* (Ehr.). Such are figs. 3, *a*, *b*, *c*, *Rotalia densa*; fig. 4, *R. senaria*; fig. 5, *R. quaterna*; fig. 6, *R. globulosa*?, 1838; fig. 7, *R. leptospira*.

Fig. 8, *Rotalia*? (*Planulina*?) *monospira*, is a rotiform *Pulvinulina* (?), with thick marginal wall and strong straight septa, and with a curious symmetrical set of holes, one at the base of each chamber, around the large, convex, central chamber. It seems to belong to the subtype *Pulvinulina elegans*, with its subquadrangular chambers; and it may be *P. Orbignyi* or *P. caracolla* (Rœmer), showing the high umbonate face. Fig. 9, *Rotalia cretæ*, is a relatively large *Planorbulina*, answering to Reuss's *Pl. ammonoides*. Fig. 10, *Planulina turgida*, and fig. 11, *Pl. sicula* (1838), are *Planulinæ*, near to, if not the same as, *Pl. ariminensis*, with falcate chambers. So also the much larger (fig. 12) *Pl. ocellaris*; but its large scattered foramina may, like those in fig. 8, possibly be due to parasitic borings*.

Figs. 13, *Pl. ampla*, and 14, *Pl. angusta*, are thick-margined and strongly septated, with triangular and oblong segments, as in fig. 8, and may be flat-face views of *Pulvinulina caracolla*, *P. ornata*, or some other of the *P. elegans* group. (See Phil. Trans. vol. clv. p. 390 &c.) Fig. 15, *Planulina spatiosa*, a young form of *Pl. spatiosa*, Ehr. (from the tripoli-shale of Oran, Africa), Monatsb. 1844, pp. 67 & 94, and 'Mikrogeol.' pl. xxi. fig. 95, is a variety of *Pulvinulina repanda*, near var. *pulchella*.

Fig. 16, *Textilaria sulcata* ("*Text. striata*, 1838") may well pass as *T. striata*, Ehr. Figs. 17, *a*, *b*, *Text. globulosa* (1838), is the common minute (arrested) form of *T. gibbosa*. Figs. 18, *a*, *b*, *Text. linearis* ("*T. aciculata*, 1838; see *Strophoconus*") is *Bolivina punctata*. As all Ehrenberg's *Strophoconi* are either *Bolivinæ* or closely allied *Virgulinæ*, the allusion to *Strophoconus* here might have been carried further with justice to our author's perspicacity. Fig. 19, *Text. dilatata* (1838), is a good *T. gibbosa*. Figs. 20, *a*, *b*, *Text. aculeata*, are separable,—20 *a* as a coarse aculeate *Text. gibbosa*, and 20 *b* as a thick-shelled variety of *Bolivina punctata*, bluntly aculeate on the outer margin of each chamber, and as such might be registered as *B. aculeata*; whilst the *Textilaria* falls to *T. subangulata*, D'Orb., 1846. Fig. 21 *a*, *Text. pachyaulax* ("compare *T. brevis*"), and fig. 21 *b*, *T. sulcata*, come under *T. striata*, Ehr.

Fig. 22, *Grammostomum polystigma*, is either a young specimen or the early chambers of a very broad strong-shelled *Bolivina dilatata*, Reuss, with short but transversely broad and falcate chambers; 23, *Gr. dilatatum*, is also a thick-shelled *Bolivina dilatata*, but with less curved and more quadrangular chambers; 24, *Gr. pinnula*, is a common *Textilaria* of the *gibbosa* type, with a smooth and evenly tapering subarcuate shell; 25, *Gr. convergens*, is probably a long-ovate well-grown *Bolivina punctata* (?), but without visible pores;

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* In specimens from the Chalk of Meudon there are frequent borings (figs. 20, 37, & 38 of pl. xxvii.).

26, *Gr. divergens*, is a subconical delicate *B. punctata*; 27, *Gr. lineare*, is a delicate subcylindrical *B. punctata* of typical character; 28, *Gr. rhomboidale*, is a relatively large *Virgulina squamosa. Virgulina* is a subgenus of *Bolivina*, having flattish, smooth, and delicate shells, with extremely fine pores, and with the chambers built up more or less regularly anglewise; whilst *Bolivina* is coarser in shell-structure, and its chambers are rounder, or at least shorter transversely. *Virgulina squamosa* comprises the very regularly Textilariform varieties; *V. Schreibersii* takes those that have long inflated chambers, variously arranged, parallel with the axis of the shell, or nearly so—sometimes resembling a *Polymorphina*, sometimes modified by a partial twist of growth and passing towards *Bulimina* proper, of which genus both *Bolivina* and *Virgulina* are sections.

Fig. 29, *Proroporus verrucosus*, is a tuberculated or coarsely granular entosolenian *Polymorphina tuberculata*, and may be added to the synonymy of that species in the "Monograph of *Polymorphina*," Linnean Soc. Transact. vol. xxvii. p. 242. Fig. 30, *Polymorphina glabra*, is *Virgulina squamosa*; and 31, *P. asparagus*, is a narrow subvariety of the same. Figs. 32–36 are various small individuals of *Virgulina Hemprichii* (Ehr.), described more fully in the 'Geol. Mag.' no. 89, p. 509; and they represent forms that may be said to be transitional between *V. Schreibersii* and *Bulimina* proper (32, *Strophoconus ovum*; 33, *Str. cepa*; 34, *Str. flosculus*; 35, *Str. gemma*; 36, *Str. gracilis*). Fig. 37, *Guttulina turrita*, = *Verneuilina pygmæa* (Egger); 38, *Pleurites turgidus*, = *Virgulina Hemprichii* (see above); an aperture, visible on the inner side of the terminal chamber, is diagnostic, as in pl. xxviii. f. 30, showing the really Bulimine character of the shell, and indicating the passage of the Virguline into the Cassiduline section of this genus.

Fig. 39, *Vaginulina linearis* (fragment), =*Marginulina ensis*, Reuss ('Böhm. Kreid.' ii. pl. 13. fig. 27). Fig. 40, *Vaginulina acuta* (fragment), belongs to the *Citharina* section of the subgenus. Fig. 41, *Planularia tenella*, is a delicate young or arrested *Cristellaria*, such as in the full-grown state would arrive at either the Planularian or the Marginuline condition.

Fig. 42, *Nodosaria aculeata*, is a very interesting thick-shelled and elongate variety of *N. radicula*, having numerous prickles, chiefly but not wholly on the base of the chambers, pointing backwards. Oblique and tapering (Dentaline) subvarieties of this form have been plentifully met with in Tertiary strata, as *Dentalina Adolphina* D'Orb. (almost straight as figured by Bornemann, from Hermsdorf), *D. scabra*, Reuss, *D. spinescens*, Reuss; and *Nodosaria hispida*, D'Orb., and *Nod. conspurcata*, Reuss (both Tertiary), are straight forms very near to Ehrenberg's *N. aculeata*; and the first takes precedence. Figs. 43, *a*, *b*, *N. vulgaris*, and fig. 44, *N. truncata*, belong to the simple elongated *N. radicula* type, with short and close-set chambers. Herein they resemble *N. glabra*, D'Orb., and the almost straight *Dent. filiformis*, D'Orb.*, still more closely, as also does the foregoing *N. aculeata*, excepting as to its prickles and straightness. *Nod. subulata* (Reuss, 'Böhm. Kreid.' ii. pl. 13. fig. 11), however, is the earliest published form with which figs. 43 and 44 most nearly correspond. Indeed, as often stated already, the differences above alluded to are not of essential value in a zoological point of view.

Fig. 45, *Miliola ovum*, =*Lagena globosa*. Fig. 46, *Miliola caudata*, =*Lagena apiculata*, Reuss (1851). Fig. 47, *Synspira triquetra*, seems to be the spiral, non-segmented commencement of some Spirilline form, assuming a triangular outline externally as it advances in growth.

Xanthidia and Coccoliths are also figured on this plate as occurring in the Chalk of Möen.

Such Foraminifera as the above are found at about 100 fathoms depth.

Species and notable Varieties from the Chalk of Möen, figured by Ehrenberg.

1. Lagena globosa (*Montagu*).
2. —— apiculata, *Rss.*
3. Nodosaria hispida, *D'Orb.*
4. —— subulata, *Rss.*
5. Vaginulina acuta, *Ehr.*
6. Marginulina ensis, *Rss.*
7. Planularia tenella, *Ehr.*
8. Polymorphina tuberculata, *D'Orb.*
9. Bolivina punctata, *D'Orb.*
10. —— dilatata, *Rss.*
11. —— aculeata, *Ehr.*
12. Virgulina squamosa, *D'Orb.*
13. —— asparagus (*Ehr.*).
14. —— Hemprichii (*Ehr.*).
15. —— —— gemma (*Ehr.*).
16. Textilaria gibbosa, *D'Orb.*
17. —— subangulata, *D'Orb.*

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* After Soldani, Ann. Nat. Hist. ser. 4, vol. viii. p. 156.

18. Textilaria pinnula, *Ehr.*
19. —— striata, *Ehr.*
20. —— globulosa, *Ehr.*
21. Verneuilina pygmæa (*Egger*).
22. Globigerina cretacea, *D'Orb.*
23. Planorbulina ammonoides, *Rss.*
24. —— globulosa (*Ehr.*).
25. Planulina ariminensis, *D'Orb.*
26. Pulvinulina elegans (*D'Orb.*)?
27. —— Orbignyi (*Rœm.*)?
28. —— spatiosa (*Ehr.*).
29. Synspira triquetra, *Ehr.*

XV. *Foraminifera from the Chalk of the Island of Rügen, Baltic.* (Monatsber. 1838, p. 192; Abhandlung. 1838, table II. pl. 4. fig. iii.)

Pl. xxx. fig. 1, *Miliola* (*Monocystis*) *arcella* ("*Orbulina universa*, D'Orb.?"), is *Orb. universa*. Fig. 2, *Nodosaria monile*, a few joints of a short-chambered *N. ovicula* (or elongated *N. radicula*); probably the straight form of *Dentalina monile*, Hagenow, from the same Chalk. Figs. 3, *a*, *b*, *Textilaria globulosa* (1838), =*b*, *T. gibbosa* and, *a*, its young form or early chambers. Figs. 4, *a*, *b*, *c*, *Text. sulcata* ("*T. striata*, 1838"), and figs. 5, *a*, *b*, *T. pachyaulax* ("compare *T. brevis*"), are strongly marked specimens of *T. striata*, which, though differing from *T. gibbosa* only in its ornament, is a convenient variety. Fig. 4 *c* shows that the septal apertures, otherwise normal, are slightly lipped. Figs. 6, *a*, *b*, *c*, *d*, *Text. linearis*, is a typical *Bolivina punctata*. Fig. 7, *Text. acuta*, is also *Bolivina punctata*, but somewhat irregular in shape; it well matches in outline *Virgulina Reussii*, Geinitz, as figured by Reuss, 'Böhm. Kreid.' i. pl. 8. fig. 61: figs. 9 & 10 of pl. xxvii. (Meudon Chalk) are very similar, but with thicker shell-walls. Fig. 8, *Text. subtilis*, is another *B. punctata*, small and regular, of a common elongate-ovate shape. Fig. 9, *Grammostomum gracile*, is a rather coarse *Virgulina Schreibersii*. Figs. 10, *a*, *b*, *Gram. platytheca*, is *Textilaria sagittula*. Fig. 11, *Gram. millepora*, is a well-grown *Bolivina dilatata* (see also fig. 15). Fig. 12, *Text. inflata* ("*T. aspera*, 1838, partly"), is a coarse-shelled *T. gibbosa*, with slight marginal prickles, like *T. subangulata* from Möen, p. 185; and fig. 13, *Gram. aculeatum* ("*Text. spinosa*, 1838, partly"), is a smaller individual with more abundant and coarser prickles on the outer edges of the chambers. These two are rough relatives of the beautifully neat and simply aculeate *Text. Mariæ*, D'Orb. Fig. 14, *Gram. pinnula*, seems to be the tapering subarcuate apex of a *Bolivina* *dilatata.* In outline it much resembles fig. 24, pl. xxix., which is also named *Gram. pinnula*; but the latter is Textilarian in the arrangement of its chambers. Fig. 15, *Proroporus? clavulina,* is a strongly built *Bolivina dilatata,* corresponding with *Bolivina incrassata* of Reuss, which he has found in the Chalk both of Lemberg and of Rügen.

Fig. 16, *Sagrina cretæ,* is a large, pouting, lipped *Bigenerina,* with a rough shell of globose chambers. It presents a stage of growth further than that of "*Loxostomum tumens,*" pl. xxviii. fig. 25 (Geol. Mag. no. 89, p. 508), having become quite uniserial, and thus passed into the subgenus *Bigenerina*; but its necked and rimmed aperture gives it the further distinctive characters of the subgenus *Heterostomella,* Reuss. The slight tuberculation visible on the edge of the figure indicates sufficiently the habit of growth so much more fully exposed in the blunt spines of *H. aculeata* (Ehr.), to which we refer also pl. xxvii. figs. 21 & 22, and pl. xxviii. figs. 25 & 26, on account of the tendency they show to take on the extension of the neck and its marginal thickening.

Fig. 17, *Grammostomum? decurrens,* is a beautiful and characteristic *Virgulina squamosa.* Fig. 18, *Polymorphina nucleus**, is a variety of *Virgulina Hemprichii*†, having a tendency towards *Cassidulina.* Fig. 19, *Pleurites calciparus,* is a Textilariform variety of *Virg. Hemprichii.* Figs. 20, *a, b, Strophoconus ovum,* is a small *Virg. Schreibersii.* Fig. 21, *Str. cepa,* being dark-shelled, is probably *Virg. Hemprichii,* young. Figs. 22, *a, b, Sphæroidina gemmula,* = *Sph. bulloides,* well figured. Figs. 23, *a, b, Rotalia globulosa* (1838), figs. 24, *a, b, R. leptospira,* and fig. 25, *R. pertusa,* are either young *Planorbulinæ* or young *Globigerinæ*; in this state they are with difficulty distinguishable. Figs. 23 & 25 resemble the early chambers of *Globigerinæ,* as shown in figs. 26 & 38; fig. 24 may be *Pl. globulosa* (Ehr.). Figs. 26, *a, b, Phanerostomum asperum,* is decidedly *Globigerina cretacea* of the subdiscoidal type. Fig. 27, *Rotalia obscura,* = *Cristellaria rotulata,* or a feebly keeled *Cr. cultrata,* like *Cr. producta,* Von Hagenow, from Rügen. Fig. 28, *Platyœcus? squama,* seems to be a variety of *Pulvinulina repanda,* and near to *Pulv. spatiosa* (Ehr.), pl. xxi. fig. 95, and pl. xxix. fig. 15. Fig. 29, *Planulina annulosa,* = *Planorbulina ammonoides.* Fig. 30, *Planulina po-*

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* This is entered with doubt among the synonyms of *Polymorphina rotundata* in the "Monograph of *Polymorphina,*" Linn. Soc. Trans. vol. xxvii. p. 234; but, together with several other Ehrenbergian species referred to in that Monograph, will have to be erased.

† For an account of this species, see also 'Geol. Mag.' no. 89, pp. 508, 509.

merana, = *Pulvinulina Micheliniana*, seen from the flat top. Fig. 31, *Pl. umbilicata*, looks somewhat like an umbonate *Cristellaria cultrata*, or rather *Cr. rotulata* with pinched edge; but it is doubtful. Fig. 32, *Nonionina? spira*, is also Cristellarian in most points, like the foregoing; but the speckled appearance is peculiar. Fig. 33, *Planulina ampliata*, =*Planorbulina ammonoides*. Fig. 34, *Cristellaria porosa*, is a fragment of some neatly grown *Planorbulina*. Fig. 35, *Cristellaria rota*, belongs to a limbated *Cr. cultrata*, such as *Cr. planicosta*, Von Hagenow, from Rügen.

Fig. 36, *Lenticulina discus*, is *Planorbulina Haidingeri*, seen with the umbilical or lower face upwards. Fig. 37, *Heterostomum alternans*, is *Virgulina Hemprichii* in a fine condition, showing the characteristic notch-like infolded apertures in two chambers, and exhibiting a transition of form towards *Cassidulina*.

Fig. 38, *Globigerina cretæ*, is a full-grown *Gl. cretacea*, having the later chambers relatively large, globose, and nearly equal (compare D'Orbigny's figure 13, pl. iii. 'Mém. sur la Craie blanche,' &c.).

Coccospheres, Coccoliths, *Pyxidicula prisca* (?), *Gallionella aurichalcea* (1838), and Spongoliths are also figured on this plate, from the Chalk of Rügen.

The foregoing lived at about 100 fathoms depth.

In 1842 Herr von HAGENOW contributed a memoir on the fossils of the Chalk of Rügen (3rd part, Mollusks) to the 'Neues Jahrbuch für Min., Geol. u. Palæont.' 1842, pp. 528–575; and at pages 568–574, and in pl. ix. figs. 20–26, are described and illustrated the Foraminifera he met with. In 1861 Prof. Dr. A. E. REUSS treated of all the Foraminifera known to him from the soft Chalk of Rügen, in 'Sitzungsberichte math.-nat. Cl. Kais. Akad. Wissensch. Wien,' vol. xliv. pp. 324–333, pl. v. figs. 6–9, pl. vi., and pl. vii. figs. 1 & 2. In cases where the species were merely mentioned by Von Hagenow in 1842, but figured and described by himself subsequently, he has decided to adopt the names given with the later and full account of the species. The following are recognized by Reuss:—

Lagena simplex, *Rss.*
—— apiculata, *Rss.*
Nodosaria monile, *v. Hag.* *Dentalina*, Rss. [=*Nodosaria monile*, Ehr.]
Dentalina sulcata, *Nilsson.*
—— Steenstrupi, *Rss.*

Frondicularia solea, *v. Hag.*
—— capillaris, *Rss.* (*Fr. lineata*, v. Hag.).
Flabellina lingula (*v. Hag.*).
—— reticulata, *Rss.*
Cristellaria rotulata (*Lam.*). [? Pl. xxx. figs. 31, 32, 'Mikrogeol.']
—— exarata, *v. Hag.*
—— planicostata, *v. Hag.* [=Pl. xxx. fig. 35, 'Mikrogeol.']
—— Spachholtzi, *Rss.* (*Cr. producta*, v. Hag.). [Compare pl. xxx. fig. 27, 'Mikrogeol.']
—— umbilicata, *Rss.*
—— Williamsoni, *Rss.*
—— navicula, *D'Orb.* (*Cr. obliqua*, v. Hag.).
—— retroflexa, *v. Hag.*
—— Marcki, *Rss.*
—— multiseptata, *Rss.*
—— nuda, *Rss.*
Haplophragmium ovatum (*v. Hag.*).
Nonionina quaternaria, *Rss.* [*Pullenia.*]
Planorbulina involuta (*Rss.*). [A plump variety of *Pl. Ungeriana*, D'Orb.]
—— constricta (*v. Hag.*). [A scarcely distinct subvariety of *Pl. ammonoides* (Rss.).]
—— ammonoides (*Rss.*) (*Planorbulina angulata*, v. Hag.). [Pl. xxx. figs. 29 & 33, 'Mikrogeologie.']
—— complanata (*Rss.*) (*Planorbulina umbilicata*, v. Hag.). [=*Pl. rotula*, (D'Orb.).*]
—— (Truncatulina) convexa (*Rss.*) (*Trunc. sublævis*, v. Hag.). [A thick subvariety of *Truncatulina lobatula.*]
Rotalia umbilicata, *D' Orb.* (*R. turgida*, v. Hag.).
—— globosa (*v. Hag.*). [Near *R. umbilicata*, D'Orb.]
Ataxophragmium obesum, *Rss.* (*Globigerina confluens*, v. Hag.).
—— Presli, *Rss.* (*Bulimina amphiconica*, v. Hag. in parte).
—— obliquum (Bulimina, *D' Orb.*), *Rss.*
Bulimina gibbosa† (Valvulina, *D' Orb.*), *Rss.* (*Valvulina quadribullata*, v. Hag.).
—— intermedia, *Rss.* (*Valvulina tribullata*, v. Hag.).

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* In this case the name given by D'Orbigny in 1846, yields precedence to that applied by Von Hagenow in 1842, unless the want of full information about the species when mentioned by the latter interferes.

† Dr. Reuss observes that the Rügen specimens have no mouth-valve, but otherwise resemble D'Orbigny's *Valvulina gibbosa*. We are satisfied that the latter is a true *Valvulina*, as well as Reuss's *Valvulina spicula* from the Bohemian Chalk.

Bulimina brevis, *D'Orb.*
—— ovulum, *Rss.* (*Bul. amphiconica*, v. Hag. in parte).
—— Puschi, *Rss.*
Guttulina cretacea, *Alth.*
Bolivina incrassata, *Rss.* (*Textularia elongata*, v. Hag.).
[Pl. xxx. figs. 11 & 15, 'Mikrogeologie.']

The following, mentioned by Von Hagenow in 1842, are not noticed by Reuss in 1861. Under the circumstances of the case, they cannot be regarded as important elements in the fossil Foraminiferal fauna of Rügen.

Nodosaria linearis (?), *Rœmer.*
Marginulina nitida, *v. Hag.*
Planularia nodosa, *v. Hag. op. cit.* pl. 9. f. 21, p. 569.
—— compressa, *v. Hag.*
Globigerina globosa, *v. Hag.*
Robulina Comptoni (*Sow.*).
—— sublævis, *v. Hag.*
—— crenata, *v. Hag.*

Species and notable Varieties from the Chalk of Rügen, figured by Ehrenberg.

1. Orbulina universa, *D'Orb.*
2. Nodosaria ovicula, *D'Orb.*
3. Cristellaria rotulata (*Lam.*).
4. —— cultrata (*Montf.*).
5. Bolivina punctata, *D'Orb.*
6. —— Reussii (*Geinitz*).
7. —— dilatata, *Rss.*
8. —— incrassata, *Rss.*
9. Virgulina squamosa, *D'Orb.*
10. —— Schreibersii, *Czjzek.*
11. —— Hemprichii (*Ehr.*).
12. —— —— nucleus (*Ehr.*).
13. —— —— calcipara (*Ehr.*).
14. Textilaria sagittula, *Defr.*
15. —— gibbosa, *D'Orb.*
16. —— subangulata, *D'Orb.*
17. —— striata, *Ehr.*
18. —— globulosa, *Ehr.*
19. Heterostomella aculeata (*Ehr.*).
20. Sphæroidina bulloides, *D'Orb.*
21. Globigerina cretacea, *D'Orb.*
22. Planorbulina ammonoides, *Rss.*
23. —— Haidingerii (*D'Orb.*).

24. Planorbulina globulosa (*Ehr.*).
25. Pulvinulina Micheliniana (*D'Orb.*).
26. —— squama (*Ehr.*).

XVI. *Foraminifera from the Chalk of Volsk, on the Volga, Russia.* (EHRENBERG, 'Das unsichtbar wirkende organische Leben,' 1842, p. 52.)

Pl. XXXI. figs. 1, *a*, *b*, *c*, *Miliola sphærula*, = *Orbulina universa.* Figs. 2 & 3, *M. paradoxa*, and fig. 4, *M. ovum*, appear to be isolated chambers of *Globigerina.* Fig. 5, *M. lævis*, is the *Lagena emaciata*, Reuss. Fig. 6, *M. stiligera*, is a *Lagena*, exactly like a recent one we have from the Abrolhos Bank, flat, elongato-lanceolate, and marginate, with a bimucronate base, due to the wing-like ends of the keel on each edge; excepting in the last-mentioned feature, it resembles fig. 46, pl. xxix. Fig. 7, *Vaginulina rotundata*, the first three chambers of a strong simple *Vaginulina* like *V. marginata*, D'Orb. Fig. 8, *Nodosaria monile*, is a rather thick-set *N. ovicula.*

Fig. 9, *Textilaria striata*, and fig. 10, *T. sulcata?* ("*T. striata?*"), are *T. striata*, Ehr. Fig. 11, *Text. amplior*, and figs. 12 & 13, *T. globulosa ampliata*, are *T. globulosa*, Ehr. (small arrested *T. gibbosa*). Figs. 14 & 15, *Text. linearis*, and fig. 16, *Grammostomum angulatum*, are small specimens of *T. agglutinans.* Fig. 17, *Text. aculeata*, is a coarse *T. gibbosa* with apiculate chamber-walls, like fig. 20 *a*, pl. xxix., and figs. 12, 13, pl. xxx., = *T. subangulata*, D'Orb. Figs. 18, 19, *Gram. rossicum*, and fig. 20, *Gr. secundarium* (?), are various specimens of *Text. sagittula.* Fig. 21, *Gr. incrassatum*, is a thick-shelled *Virgulina Schreibersii.* Fig. 22, *Gr. attenuatum*, is *Bolivina dilatata* with a strong shell. Figs. 23 & 24, *a*, *b*, *c*, *Gram. pachyderma*, and fig. 25, *Gr. thebaicum* (?), are coarse-shelled *Virg. Schreibersii.* Fig. 26, *Gr. laxum* (?), is *Polymorphina lactea.* Fig. 27, *Gr. megaloglossum*, is a fragment of a large *Virgulina squamosa.*

Fig. 28, *Sagrina cretæ*, represents a strong but somewhat ill-grown individual of the pouting *Bigenerina*, with slightly dentate chamber-margins, referred to *Heterostomella aculeata* (pl. xxx. fig. 16) at page 189. Fig. 29, *Loxostomum tumens*, is a fine, free-grown, smooth-shelled individual of the same species. Fig. 30, *Polymorphina acanthophora*, and fig. 31, *P. obtusa*, appear to be young Bigenerine specimens allied to the last mentioned, but with longer and straighter flask-like chambers, nearly parallel to the axis of the shell. A spike on the base of the shell gives the name to the larger specimen; but this feature is indicated on the other also. They nearly conform with *B.* (*Gemmulina*) *digitata*, D'Orb.

Fig. 32, *Strophoconus ovum*, and figs. 33 & 34, *St. spicula*, are small coarse-shelled *Virgulinæ Schreibersii*. Figs. 35 & 36, *Pyrulina ovulum*, = *Polymorphina lactea*. Fig. 37, *Pleurites turgens*, probably *Virgulina Hemprichii*, but doubtful; it may possibly be a *Polymorphina*. Figs. 38–53 represent different ages, stages, and conditions of *Globigerina cretacea* (fig. 38, *Rotalia perforata*; fig. 39, *R. quaterna*; figs. 40, 41, 43, *R. globulosa*; fig. 42, *R. laxa*; fig. 44, *R. aspera*; fig. 45, 49, *R. leptospira*; figs. 46, 47, *R. senaria*; fig. 48, *R. glomerata*; figs. 50, 51, *R. wolgensis*; fig. 52, *Planulina incurvata*, showing the diagnostic aperture; and fig. 53, *Pl. ocellata*).

Fig. 54, *Lenticulina? pachyderma*, = *Pulvinulina caracolla* (Rœm.). Fig. 55, *Planulina umbilicata* (?), represents the central chambers of a *Planulina*; compare fig. 60 for instance. Fig. 56, *Pl. porophæna*, and fig. 57, *Pl. pardalis*, are relatively large specimens of probably *Planulina ariminensis*. Fig. 58, *Lenticulina discus*, = *Planorbulina Haidingerii*, almost of the typical form. Fig. 59, *Planulina micromphala*, fig. 60, *Pl. ampliata*, and fig. 61, *Pl. ampla*, are all probably *Planulinæ* belonging to the *Pl. ariminensis* type.

Fig. 62, *Pl. turgida*, seems to be a small *Operculina*. This subgenus of *Nummulina* is rare in the Cretaceous strata, and therefore the Russian specimen is of great interest. Two *Operculinæ* (one described and figured by Reuss as *Amphistegina Fleuriasi*, D'Orb., and the other as *Op. cretacea*) occur in the Maestricht Chalk, 'Sitzungsber. Akad. Wien,' vol. xliv. pp. 308, 309, pl. i. figs. 10–12, and pl. ii. fig. 1, *a*, *b*. Another, described and figured by Reuss as *Amphistegina clypeolus* (Zeitschr. Deutsch. geol. Gesellch. vol. vii. pl. ix. fig. 9), was found, in Upper Chalk of the same age as that of Maestricht, at Mecklenburg. From the Lower Cretaceous formation in the Haute-Marne, France, M. Cornuel has a somewhat doubtful *Operculina* (*Op. angularis*), Mém. Soc. Géol. France, ser. 2, vol. iii. part 1, Mém. no. 3, pl. 2. figs. 20–22.

Coniostylis and Coccoliths are also figured on this plate.

The group of Foraminifera here represented belonged to a fauna inhabiting a shallower part of the sea than that with the western Chalk, probably from 50 to 100 fathoms in depth.

Species and notable Varieties from the Chalk of Volsk, Russia, figured by Ehrenberg.

1. Orbulina universa, *D'Orb.*
2. Lagena emaciata, *Rss.*
3. —— stiligera (*Ehr.*).
4. Nodosaria ovicula, *D'Orb.*

5. Vaginulina marginata, *D'Orb.*
6. Polymorphina lactea (*W. & J.*).
7. Bolivina dilatata, *Rss.*
8. Virgulina squamosa, *D'Orb.*
9. —— Schreibersii, *Czjzek.*
10. —— Hemprichii (*Ehr.*)?
11. Textilaria agglutinans, *D'Orb.*
12. —— sagittula, *Defr.*
13. —— gibbosa, *D'Orb.*
14. —— subangulata, *D'Orb.*
15. —— globulosa, *Ehr.*
16. Bigenerina acanthopora (*Ehr.*).
17. Heterostomella tumens (*Ehr.*).
18. —— aculeata (*Ehr.*).
19. Globigerina cretacea, *D'Orb.*
20. Planorbulina Haidingerii (*D'Orb.*).
21. Planulina ariminensis, *D'Orb.*
22. Pulvinulina caracolla (*Rœmer*).
23. Operculina turgida (*Ehr.*).

XVII. *Foraminifera from the Chalk of the Upper Missouri, North America.* (Monatsber. 1842, p. 187; Abhandl. 1841, pp. 365, 398, 429, 433 [1843].)

In the 'American Journal of Science and Arts,' vol. xli., October 1841, pp. 400–402, the late Prof. J. W. Bailey gave an account of some "American Polythalamia from the Upper Mississippi, and also from the Cretaceous Formation on the Upper Missouri;" and in vol. xlvi. p. 297, &c., the researches of Ehrenberg in these Cretaceous Foraminifera of America are treated of in connexion with a *résumé* of the results of his examination of large quantities of both North- and South-American Microzoic deposits, recent and fossil*. At page 307 a woodcut outline of *Textilaria missouriensis*, Ehr., is inserted in a footnote. In the Am. Journ. Sc. vol. xlviii. (1845), p. 341, Prof. Bailey gives a list of the American rocks in which Foraminifera had been found, and from which specimens had been sent to Dr. Ehrenberg.

Pl. XXXII. I. figs. 1, *a*, *b*, *Miliola?* (*Vaginulina?*) *bursa*, are obscure; possibly *Euglypha* or *Protocystis*. Fig. 2, *Nodosaria vulgaris*, two chambers of *N. glabra*, D'Orb. Fig. 3, *Nod. acus*, is the early portion of an extremely attenuate and scarcely segmented variety of *N. ovicula*. A similar specimen has been figured by Prof. Bailey from the deep soundings off New Jersey and Delaware ('Smithsonian Contrib.' 1861, fig. 8). Fig. 4, *a*,

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* Abhandlungen Akad. Berlin for 1841 (1843).

Textilaria americana ("1843, pp. 398, 429"), is a variety of *T. striata*, with the outer margins of the younger and larger chambers more or less produced and aculeate. Fig. 4 *b*, *T. striata*, is the early portion of *T. americana*, simply *T. striata* with pores in the fine furrows*. Fig. 5, *T. missouriensis*, is *T. gibbosa* becoming laterally aculeate, as in fig. 4 *a*, but without striæ. Fig. 6, *T. proroconus*, is simply *T. gibbosa* with bored holes. Fig. 7, *T. americana* (?), young, is the same as fig. 4 *b*, with thicker shell. Fig. 8, *T. globulosa*, is a small, stout, oblong *T. gibbosa*. Fig. 9, *T. euryconus*, is a much larger *T. gibbosa*. Fig. 10, *T. gomphoconus*, is a neat, narrow, tapering *T. gibbosa*. Fig. 11, *Grammostomum americanum*, is *Virgulina Schreibersii*. Fig. 12, *Gr. validum*, is a small, stout, squarish *Textilaria* of the *gibbosa* type. Figs. 13, 14, *Spiroplecta americana* ("*Heterohelix*, 1843, p. 429"), is the same as 4 *a*, excepting that the first segments have a spiral growth. This variation is common in the *Textilaridæ*, and, like analogous differences in growth, has been accepted as the basis for subgeneric division.

Figs. 15, *Phanerostomum porulosum*, fig. 16, *Ph. dilatatum*, figs. 17 & 18, *Ph. lacerum*, fig. 19, *Ph. læve* (small and round), and fig. 20, *Ph. quaternarium*, are stages and conditions of *Globigerina hirsuta*, D'Orb., a subdiscoidal variety of *Gl. bulloides*, which is extremely acerose, and has very wide septal apertures. This is the *Globigerina* that abounds in the Red Sea and Indian Ocean; it is often outspread and very prickly, sometimes having its apertures closed over with the projecting and interlacing needles. Fig. 21, *Rotalia globulosa-protolepta*, is a small arrested or young *Planorbulina vulgaris* (*Pl. globulosa*). Fig. 22, *Phanerostomum hispidulum* (small and roughish), fig. 23, *Ph. hexaleptum* (small and smooth), fig. 24, *Ph. asperum* (tuberculate), fig. 25, *Ph. senarium* (aculeate), fig. 26, *Planulina globigerina* (large and tuberculate), fig. 27, *Ptygostomum senarium* (small and aculeate), fig. 28, *Pt. quinarium* (small and smooth), fig. 29, *Phanerostomum hispidulum* (small and tuberculate), fig. 30, *Ph. dilatatum* (aculeate), and fig. 31, *Ph. hexacyclus* (tuberculate) are also specimens of *Globigerina hirsuta*, D'Orb., 'Foram. Canaries,' pl. ii. figs. 4–6.

Fig. 32, *Rotalia lenticulina*, is possibly a *Cristellaria*; or it may be a *Nonionina*; but its scattered granules constitute a doubtful character, and the position of the septal apertures is not indicated. Other specimens referred to "*Rotalia lenticulina*," in other plates, appear to be *Planorbulinæ*.

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* Dr. J. G. Egger figures and describes a Miocene *Textilaria* like this from Lower Bavaria; *Text. striato-punctata*, Eg. 'Neues Jahrb.' 1857, pl. 8. figs. 27–29.

Coccoliths are also given on this plate in fig. I. B.

This Chalk was probably formed in about 50 to 100 fathoms.

Species and noticeable Varieties from the Chalk of the Upper Missouri, figured by Ehrenberg.

1. Nodosaria glabra, *D'Orb.*
2. —— acus, *Ehr.*
3. Cristellaria?
4. Virgulina Schreibersii, *Czjzek.*
5. Textilaria gibbosa, *D'Orb.*
6. —— missouriensis, *Ehr.*
7. —— striata, *Ehr.*
8. —— (*et* Spiroplecta) americana, *Ehr.*
9. —— striato-punctata, *Egger.*
10. Globigerina hirsuta, *D'Orb.*
11. Planorbulina globulosa (*Ehr.*).

XVIII. *Foraminifera from the Chalk of the Upper Mississippi, North America.* (Monatsb. 1842, p. 187; Abhandl. 1841, pp. 365, 433 [1843].)

In the 'Americ. Journ. Sc.' vol. xli. p. 400, the material examined by Dr. Ehrenberg is described as "a light cream-coloured marl from a Mission-station on the Upper Mississippi, called there 'prairie chalk,'" and some unnamed woodcut outlines of the Foraminifera are given (p. 401), namely:—figs. 1 & 2, *Textilaria gibbosa*; fig. 3, *Cristellaria cultrata*, with narrow falcate chambers; fig. 4, a small *Planorbulina.*

Pl. XXXII. II. fig. 1, *Miliola striata*, =*Lagena costata*, Williamson. Fig. 2 *a*, *M. lævis*, =*L. emaciata*, Reuss. Fig. 2 *b*, *Ovulina clava*, =*L. clavata*, D'Orb. Fig. 3, *Dentalina americana*, = *D. Boueana*, D'Orb. Fig. 4, *Nodosaria tumescens*, = *N. ovicula*, D'Orb. Figs. 5, *N. vulgaris*, and 6, *N. ampla*, = *N. glabra*, D'Orb. Fig. 7, *Vaginulina calcipara*, fig. 8, *V. cretæ*, and fig. 9, *V. subacuta*, = *V. leguminiformis* (Batsch). Fig. 10, *Planularia elongata*, is a simple subcarinate *Planularia*, or an elongate Marginuline *Cristellaria cultrata*, and is known as *Pl. crepidula* (F. & M.).

Fig. 11, *Textilaria striata*, is a thick-shelled *T. striata.* Fig. 12, *Text. globulosa*, is the common small form of *T. gibbosa*, and so is fig. 13. Fig. 14, *T. striata*, is a rather narrow *T. striata.* Fig. 15, *Grammostomum americanum*, is *Bolivina dilatata*, with a faintly reticulated surface. Fig. 16, *Gr. phyllodes*, = *Virgulina squamosa.* Fig. 17, *Gram. invalidum*, is a small *Textilaria* of the *agglutinans* type. Fig. 18, *Gr.*

tessera, is an outspread, rhomboidal, Textilariform *Virgulina Hemprichii*. Fig. 19, *Gr. rhomboidale*, = *Bolivina dilatata*. Fig. 20, *Pleurites? americanus*, is a suboblong Textilariform *Virgulina Hemprichii*. Fig. 21, *Strophoconus spicula?*, is a young *Virg. Schreibersii*, with a mode of growth approaching that of *Bulimina elegantissima*.

Fig. 22, *Sagrina longirostris*, is "*Loxostomum tumens*," the smooth form of *Heterostomella aculeata*, not having grown gross enough to produce exogenous shell-matter. Fig. 23, *Proroporus obtusus*, is *Polymorphina compressa*. Fig. 24, *Pr. obtusus?*, is a Bigenerine *Textilaria*, near to *Bigenerina acanthophora*, pl. xxxi. figs. 30, 31, and may pass as *B. digitata*. Fig. 25, *Spiroplecta americana* ("*Heterohelix*, 1843, p. 429"), is *Text. gibbosa* with a spiral commencement, but without the ornament of figs. 13 & 14 on the upper portion of this plate. Fig. 26, *Spiroplecta rosula*, is a straight-sided *Textilaria* of the *agglutinans* type, but commencing its growth with a large coil of chambers. This species lives in the Atlantic, and in its sandy condition has of late years been named by us *Text. biformis*[*], and in the clear-shell state has received the name of *T. complexa* from Mr. H. B. Brady[†]; but Ehrenberg's name has precedence.

Fig. 27, *Dimorphina saxipara*, is an interesting specimen of *Virgulina Schreibersii* that has formed the latter part of its shell in a uniserial manner, and has thus become Dimorphine; but the name "*Dimorphina*" is limited to the Dimorphous forms of *Polymorphina*. In *Cassidulina*, which is a very close ally of *Virgulina*, we occasionally see evidences of weak and rapid growth in one-sidedness and linear direction of the segments (*Ehrenbergina*). In accordance with the plan of nomenclature among Foraminifera, the dimorphous varieties of *Bulimina*[‡], *Virgulina*, *Bolivina*, and *Cassidulina* require one or more subgeneric appellations. We propose *Bifarina* for the dimorphous *Virgulina*; and *Bif. saxipara* is the name with which the interesting American specimen under notice will be registered.

Fig. 28, *Guttulina turrita*, = *Verneuilina pygmæa* (Egger). Fig. 29, *Frondicularia? strophoconus*, is a small, smooth, acute-ovate *Glandulina lævigata*, looking flat by reason of its transparency.

Fig. 30, *Rotalia senaria*, fig. 31, *R. globulosa-protolepta*, and fig. 32, *R. leptospira*, are smooth, polished and apparently poreless, and, with their numerous globose limbate chambers, are readily identified as *Pulvinulina canariensis* (D'Orb.), 'Hist. Nat. Canaries, Foram.,' pl. 1. figs. 34–36. Fig. 33, *Rotalia calcipara*, and fig. 34, *Omphalophacus? tenellus*, belong to a somewhat prickly variety of *Pulvinulina Menardii*, D'Orb. Fig. 35, *Planulina nebulosa*, is obscure; perhaps a *Planorbulina*.

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[*] Philos. Trans. 1862, vol. clv. p. 370, pl. 15. figs. 23, 24.

[†] Nat. Hist. Trans. Northumberland and Durham, vol. i. part 1, 1865, pl. 12. fig. 6, p. 101.

[‡] *Bulimina variabilis*, D'Orb., may be said to be dimorphous in this sense.

Fig. 36, *Rotalia nonas* (?), may be an umbonate and limbated *Cristellaria rotulata* (?). Fig. 37, *Cristellaria alta*, is a young *Cristellaria cultrata*. Fig. 38, *Aspidospira saxipara*, is *Planulina ariminensis* with large scattered foramina. Fig. 39, *Robulina? denaria*, seems to be an umbonate *Cristellaria rotulata*. Fig. 40, *Rotalia heptas*, is probably the same as fig. 36. Figs. 41, *Planulina mississippica*, 42, *Phanerostomum asperum*, 43, *Planulina oligosticta*, 44, *Phan. globulosum* (young), 45, *Rotalia globulosa-protolepta* (young and smooth), and 46, *Phan. quaternarium* (young and smooth), are subvarieties and conditions of a large, outspread, tuberculated *Globigerina* of the *cretacea* subtype; and not nearly so acerose, nor with such patulous apertures, as the fossil *Globigerina* from the Upper Missouri, figured in the upper part of this plate. Fig. 47, *Robulina ocellus*, is a young *Cristellaria cultrata*. Fig. 48, *Planulina suboctonaria*, is *Planorbulina ammonoides*.

Coccoliths also are indicated in the text.

The group indicates about 50 to 100 fathoms depth.

Species and noticeable Varieties from the Chalk of the Upper Mississippi, figured by Ehrenberg.

1. Lagena costata, *Williamson.*
2. —— emaciata, *Rss.*
3. —— clavata, *D'Orb.*
4. Glandulina lævigata, *D'Orb.*
5. Dentalina Boueana, *D'Orb.*
6. Nodosaria ovicula, *D'Orb.*
7. —— glabra, *D'Orb.*
8. Vaginulina leguminiformis (*Batsch*).
9. Planularia crepidula (*F. & M.*).
10. Cristellaria rotulata (*Lamk.*).
11. —— cultrata (*Montf.*).
12. Polymorphina compressa, *D'Orb.*
13. Bolivina dilatata, *Rss.*
14. —— americana, *Ehr.*
15. Virgulina squamosa, *D'Orb.*
16. —— Schreibersii, *Cz.*, var.

17. Virgulina Hemprichii (*Ehr.*).
18. —— —— tessera (*Ehr.*).
19. —— —— americana (*Ehr.*).
20. Bifarina saxipara (*Ehr.*).
21. Textilaria agglutinans, *D'Orb.*
22. —— gibbosa, *D'Orb.*
23. —— striata, *Ehr.*
24. —— globulosa, *Ehr.*
25. Spiroplecta americana, *Ehr.*
26. —— rosula, *Ehr.*
27. Bigenerina digitata, *D'Orb.*
28. Heterostomella tumens (*Ehr.*).
29. Verneuilina pygmæa (*Egger*).
30. Globigerina cretacea, *D'Orb.*
31. Planorbulina ammonoides (*Rss.*).
32. Planulina ariminensis (*D'Orb.*).

[To be continued.]

XXVIII.—*A Monograph of the Genus* Thelyphonus.

By Arthur G. Butler, F.L.S., F.Z.S., &c.

[Plate XIII.]

The first monograph of this genus was that by M. Lucas in the 'Magasin de Zoologie' for 1835, in which six species were recognized, five of them being then described for the first time.

In 1843 Koch added five new forms in his 'Arachniden,' since which time three others have been diagnosed, one of them being probably the adult type of a previously described species.

I have now to add eight more species, which, considering that one of those described by M. Lucas is apparently a young form of the *T. proscorpio* of Latreille (hitherto confounded with *T. caudatus*, Linn.), will bring the number of known *Thelyphoni* up to twenty-one.

In the present paper I have separated the species into three sections according to the number of teeth on the second joint of the cheliceres. This important character, which appears to be very constant, has been much neglected in descriptions, and still more so in figures of the various species; very little attention has also been paid to the amount of rugosity, or the hairiness of the cheliceres, legs, &c., though in the order Coleoptera such characters are considered of the utmost importance, as, indeed, they may be shown to be in the present order.

The species of *Thelyphonus* in their general appearance remind one strongly of the two genera *Lucanus* and *Nepa*.

Fam. **Thelyphonidæ**, Wood.

Genus THELYPHONUS, Latreille.

Section *a*. *Species with five spines on upperside of second joint of cheliceres.*

1. *Thelyphonus giganteus.*

Thelyphonus giganteus, Lucas, Monogr. in Guérin's Mag. de Zool. pl. 8 (1835); Koch, Arachn. x. p. 21, pls. 331, 332, figs. 767, 768 (1843).
Thelyphonus excubitor, Girard, Marcy's Report of Expl. of Red River, p. 265, fig. xvii. 1–4.

Hab. Mexico (*Oaxaca*). Obtained 1858, from M. Sallé. B.M.

2. *Thelyphonus mexicanus*, n. sp. Pl. XIII. fig. 1.

Colour chocolate-brown.

Allied to *T. giganteus*, one third smaller; cephalothorax narrower, more pointed in front and less rugose; abdomen with the sides much more parallel; the stigmatiform spots much better defined; the granular rugosities less distinct; cheliceres, excepting the second joint, more rugose and pilose, the latter joint broader; the teeth above quite different in arrangement, five in number, the first two and the fifth very short and blunt, the fourth slightly longer, the third twice the length of the fourth; a space between the second and third; third joint with external rugosities lengthened, rendering it distinctly spinous; fourth joint more pilose; legs less rugose, more pilose.

Length of cephalothorax and abdomen 1 inch 9½ lines.

Hab. Mexico. B.M.

3. *Thelyphonus brasilianus.*

Thelyphonus brasilianus, Koch, Arachn. x. p. 24, pl. 338. fig. 770 (1843).

Hab. Brazil. B.M.

4. *Thelyphonus amazonicus*, n. sp. Pl. XIII. fig. 2.

Seems allied to *T. spinimanus* and *T. antillanus*, but may be at once distinguished from both by its more cylindrical abdomen, which has no marginal ridge as in those species.

Colours: cephalothorax above black, somewhat shining; abdomen dull black; cheliceres shining, pitchy, last joint reddish; legs and caudal appendage reddish, varied with greyish black; entire central region below shining red.

Cephalothorax very slightly rugose, oblong, triangular in front; abdomen half as long again, subcylindrical; stigmatiform depressions ill-defined; tail setose throughout its entire length: cheliceres quite smooth; second joint with five short teeth above, the second broad and prominent, the fifth very minute; third joint with one short tooth on its inner margin below; fourth joint with inner edge of terminal spine and outer edge of fixed finger of chelæ distinctly serrated; legs smooth.

Length 7½ lines.

Hab. Santarem, Alter do Chao (*Bates*). B.M.

5. *Thelyphonus antillanus.*

Thelyphonus antillanus, Koch, Arachn. x. p. 29, pl. 334. fig. 773 (1843).
Theliphonus caudatus, Guérin (nec Linn.), Cuvier's Règne Anim. Arach. p. 11, pl. 3. fig. 3 (1829–44).
Thelyphonus antillianus, Lucas, in Ramon de la Sagra's Hist. de l'île de Cuba, pl. 5. figs. 4, 4*a* (1857).

Hab. Haiti. B.M.

6. *Thelyphonus rufimanus.*

Thelyphonus rufimanus, Lucas, Monogr. in Guérin's Mag. de Zool. pl. 8. fig. 1 (1835).
Adult. *Thelyphonus assamensis*, Stoliczka, Journ. Asiat. Soc. Bengal, xxxviii. p. 205, pl. 19. fig. 1 (1869).

Hab. "Java" (*Lucas*); "Assam" (*Stoliczka*); Silhet (*Stainsforth*); "India," from Mr. Argent. B.M.

Young specimens agree precisely with M. Lucas's figure; but I doubt the occurrence of this species in Java. It seems the commonest of all the *Thelyphoni*.

7. *Thelyphonus proscorpio.*

Thelyphonus proscorpio, Latreille, Gen. Crust. & Ins. i. p. 130. n. 1; Koch, Arachn. x. p. 26, pl. 333. fig. 771 (1843).
Thelyphonus caudatus, Lucas (nec Linnæus), Monogr. in Guérin's Mag. de Zool. pl. 9. fig. 1 (1835).
? Young. *Thelyphonus angustus*, Lucas, *loc. cit.* pl. 10. fig. 3 (1835).

Hab. Bengal, presented by Gen. Hardwicke. B.M.

8. *Thelyphonus linganus.*

Thelyphonus linganus, Koch, Arachn. x. p. 31, pl. 335. fig. 774 (1843).

Hab. "Linga" (*Koch*); Borneo, from Mr. Stevens. B.M.

9. *Thelyphonus australianus.*

Thelyphonus australianus, Koch, Arachn. x. p. 33, pl. 335. fig. 775 (1843).

Hab. Australasia, from Sir J. Liddell (Voy. Herald); Aneiteum, New Hebrides, from Mr. Cuming. B.M.

10. *Thelyphonus rufipes.*

Thelyphonus rufipes, Lucas, Monogr. in Guérin's Mag. de Zool. pl. 9. fig. 2 (1835); Koch, Arachn. x. p. 23, pl. 332. fig. 769 (1843).

Hab. ——? B.M.

11. *Thelyphonus manilanus.*

Thelyphonus manilanus (sic), Koch, Arachn. x. p. 28, pl. 334. fig. 772 (1843).

Hab. Philippines. B.M.

12. *Thelyphonus proboscideus*, n. sp. Pl. XIII. fig. 3.

Colours: black above, with legs, tail, and apex of cephalothorax chestnut-red; cheliceres shining chocolate-brown; below shining pitchy, with basal joint of cheliceres, legs, tail, base and central region of abdomen more or less red.

Cephalothorax elongate, somewhat rugose, triangular in front, where it culminates in a depressed, well-defined, red tooth or spine; abdomen covered with minute granular rugosities; the segments minutely serrated, the last segment before the tail strongly excavated; stigmatiform depressions well defined: cheliceres varying in length, slightly wrinkled transversely; basal joint terminating anteriorly in an enormous spine, toothed internally at its base and pilose; second joint with five teeth above, the first and second large, separated by an interval from each other, the third, fourth, and fifth about half the length of the others, situated upon the interior margin, which is also somewhat pilose, interior surface bearing several denticulate rugosities, inferior margin bearing two teeth; third joint elongate, cylindrical, with one spine below; fourth joint distinctly rugose, with a large blunt protuberance on its lower surface; terminal spine very prominent, blunt, somewhat curved, and ending abruptly in a short conical tooth: chelæ pilose, dentated internally, the fixed finger, which is very short and spine-like, externally; when closed with the terminal spine of third joint they appear as a compact, quadrate, compressed plate, terminating above in two diverging teeth: legs and caudal appendage slightly rugose and pilose.

Length 1 inch.

Hab. Ceylon (*E. L. Layard*). B.M.

A very remarkable new species, and unlike any thing previously described in the genus.

Section *b*. *Species with two spines on upper surface of second joint of cheliceres.*

13. *Thelyphonus formosus*, n. sp. Pl. XIII. fig. 4.

Allied to *T. proboscideus*; colours the same; cephalothorax without apical spine, otherwise very similar; cheliceres somewhat long, nearly smooth, sparsely but distinctly punctured; basal joint of ordinary type; second joint slightly wrinkled, with only two minute teeth above, its inner surface somewhat denticulate and pilose; third joint with one small tooth below; fourth joint with large, curved, terminal spine, terminating above in a minute blunt fork, one tooth of which is bifid, and below in a rounded protuberance; chelæ short and rounded, fixed finger short and somewhat conical, serrate and pilose externally; moveable finger long, curved, pilose; legs covered with granular rugosities.

Length 11 lines.

Hab. Moulmein (*Archdeacon Clerk*). B.M.

Section c. *Species with six spines on upperside of second joint of cheliceres.*

14. *Thelyphonus pugnator*, n. sp. Pl. XIII. fig. 5.

Allied to *T. manilanus* and *T. proboscideus.* Form of cephalothorax and abdomen as in the former; colours as in the latter species; cephalothorax less rugose than in *T. manilanus*; abdominal segments not serrated; cheliceres very long, nearly smooth, shining, clothed internally with long lake-red hairs; basal joint with short blunt spine, terminating in a small conical tooth; second joint with six small teeth above, an interval between each of them, the first smallest, the third largest; two minute teeth below; inner surface denticulate; third joint cylindrical, without tooth*; fourth joint rather short, with very long terminal spine; chelæ long, flattened externally; the fixed finger broad, compressed, and strongly curved, serrated internally; movable finger long, nearly straight, bifid at its extremity, serrated on both edges, but most coarsely externally; legs covered with granular rugosities.

Length 1 inch 5 lines.

Hab. Philippines. B.M.

The most remarkable of all the species of *Thelyphonus.*

15. *Thelyphonus spinimanus.*

Thelyphonus spinimanus, Lucas, Monogr. in Guérin's Mag. de Zool. pl. 10. fig. 2 (1835).

Probably a New-World species.

16. *Thelyphonus Stimpsonii.*

Thelyphonus Stimpsonii, Wood, Proc. Acad. Nat. Sci. Philad. p. 312 (1861).

Hab. "Japan" (*Wood*); Hongkong (*J. Bowring, Esq.*). B.M.

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* On the left-hand chelicere there is a minute tubercle, which probably represents the missing tooth.

In our example the first tooth on the inner edge of the second joint (first joint of Wood) is almost imperceptible; so that there seem at first sight to be only four, instead of five teeth.

17. *Thelyphonus seticauda.*

Thelyphonus seticauda, Doleschall, Natuurk. Tijdschr. voor Nederl. Indië, xiii. p. 404 (1857).

Hab. "Amboina" (*Doleschall*); Ceram (*Madame Ida Pfeiffer*). B.M.

18. *Thelyphonus lucanoides*, sp. n. Pl. XIII. fig. 6.

Closely allied to *T. seticauda*, but considerably larger and darker; the cephalothorax comparatively longer and narrower, with the fork of the median depression terminating also much further from its inferior edge; the abdomen more cylindrical and with less distinct marginal ridge; the cheliceres more distinctly punctured.

Length 1 inch 1 line.

Hab. Corea (*Arthur Adams, Esq.*). Two specimens. B.M.

A local representative of *T. seticauda.*

19. *Thelyphonus caudatus.*

Phalangium caudatum, Linnæus, Syst. Nat. 1, ii. p. 1029. n. 8 (1766)
Sulzer, Gesch. Ins. pl. 29. fig. 11 (1776).
Tarantula caudata, Fabricius, Ent. Syst. ii. p. 433. n. 2 (1793).

Hab. Madras (French rocks) (*Mrs. Hamilton, Vigors's coll., Mr. Jerdon*); Bengal (*Gen. Hardwicke*); Tenasserim (*J. C. D. V. Packman*); Ceylon (*E. W. Janson*). B.M.

A broad, well-marked form, having six teeth on second joint of cheliceres and a very depressed abdomen; it has been confounded with two, if not three, other species.

20. *Thelyphonus sinensis*, n. sp. Pl. XIII. fig. 7.

Allied to *T. caudatus*, but larger and blacker; cephalothorax comparatively longer; cheliceres duller and less rugose, second joint with all the teeth considerably longer, the third being most prominent.

Length 1 inch 7 lines.

Hab. Hongkong, from J. C. Bowring, Esq. B.M.

Unquestionably a local form of *T. caudatus*, but sufficiently different to require a distinctive name.

21. *Thelyphonus rufus*, n. sp. Pl. XIII. fig. 8.

Allied to *T. rufipes*, but much larger and entirely of a reddish-chestnut colour; the cheliceres much more coarsely punctured, and with the external edge very setose; terminal segment of abdomen more transverse.

Length 1 inch 6 lines.

Hab. Locality unknown. B.M.

Looks, at first sight, like a red specimen of *T. sinensis*; but the sculpture, pilosity, and dentation of the cheliceres are quite different.

XXIX.—*Notes on a new* Propithecus *and the Fossane from Madagascar.* By Dr. J. E. Gray, F.R.S. &c.

The British Museum has lately received a number of mammalia from Madagascar collected by Mr. Crossley. The two following are quite new to the Museum collection, and, I believe, new to modern science.

1. *Propithecus bicolor.*

Black; middle of back and loins white, with a central black streak; brownish on the margin.

Madagascar.

The white on the back is marked with a more or less distinct, central, longitudinal black line, which is most distinct and extends nearly to the rump in one of the specimens.

In the other specimen, that has not this line so distinctly marked, the middle of the back is brownish. In both specimens the hinder part of the thigh is rather brown; the tail is slender, of an intense black, and about the length of the body.

The two specimens are very much alike in size and colour, and very different from the other three species in the Museum. They are very like *Indris brevicaudatus*; but they have a distinct tail, like the other *Propitheci.*

2. I have no doubt that this is the animal described by Buffon (Hist. Nat. xiii. p. 163, t. 21), received from M. Poivre, who sent it to the Academy of Sciences in 1761, but which of late has been unknown to naturalists. I was so satisfied from the description and figure that it was separate from the other known *Viverræ*, that in the 'Proc. Zool. Soc.' for 1864 I established for it a genus of the name of *Fossa*; and this is repeated in the 'Catalogue of Carnivorous, Pachydermatous, and Edentate Mammalia in the British Museum;' but various zoologists have decided that this was a mistake. The Museum has now received a male and a female and a skeleton of an animal that I have no doubt is the Fossane; and it proves to be a very distinct genus, having the soles of the

hind feet entirely hairy, like the *Viverricola*; but it differs from that animal in having no lunate mark on the front of the chest; and the tail is only marked with a series of spots on each side of the upper part, very unlike the distinct rings of *Viverricola*. It ought to be arranged in the tribe Viverrina, next to *Viverricola*, and not, as placed in the Catalogue, after *Genetta*, in the tribe Genettina.

FOSSA, Gray, P. Z. S. 1864, and Cat. Carn. Mam. Brit. Mus. p. 52.

Head tapering. Throat pale, without any lunate bands. Body elongate; back not crested. Legs moderate, equal. Tail shorter than the body, grizzled, with a series of dark spots on each side of the basal half, and very indistinct interrupted dark rings on the hinder half; underside not ringed or spotted. Soles of the hind feet entirely hairy, without any naked streak, extending from the base of the toes to the heel.

1. *Fossa Daubentonii*, Gray, P. Z. S. 1864, p. 518; Cat. Carn. Mam. B. M. p. 62.

Fossane, Buffon, Hist. Nat. xiii. p. 163, t. 21.
Viverra fossa, Schreb. Säugeth. t. 114 (from Buffon).

Hab. Madagascar. B.M.

I will on a future occasion give a longer description, with an account of the dentition and skeleton, of this long-lost and much misunderstood beast.

Buffon and Daubenton described a specimen brought home by M. Poivre in 1761, which was afterwards in the Museum of the Jardin des Plantes. When I have been in Paris I have searched for it two or three times without being able to discover it; so that I fear the original specimen has been lost; and I regard the rediscovery of the animal as quite as important as the finding of a new species. Daubenton's description is very accurate. It is at once known from *Viverricola malaccensis* and *Genetta*, with which some zoologists have confounded it, by having no lunate bands on the throat.

XXX.—*On the double-horned Asiatic Rhinoceros* (Ceratorhinus). By Dr. J. E. GRAY, F.R.S. &c.

THE Zoological Society has, within this last year, received two specimens of the double-horned Asiatic rhinoceros (*Ceratorhinus*). They are very unlike one another, and come from different but neighbouring parts of South Asia, both being females and nearly adult. There is every reason to suppose that they are distinct species. Both have been called the hairy rhinoceros, or *Rhinoceros sumatrensis*. The one comes from Chittagong, and the other from Malacca; and Mr. Blyth supposes that the one inhabits the east coast of the Bay of Bengal and the series of islands extending to Sumatra, and the other the Malay peninsula and Tenasserim, separated in Burmah by the Irrawaddy river.

The one from Chittagong is covered with soft hair, and the ears are surrounded by a fringe of long hairs; I have no doubt this is the double-horned rhinoceros of Sumatra, described by W. Bell in the 'Philosophical Transactions,' January 10, 1793. Mr. Bell describes the "general colour as brownish-ash. Underside of belly between the legs and folds of skin dirty flesh-coloured. Ears small and pointed, lined on the edge with short black hair. Upper lip pointed and hanging over the under. Whole skin rough, and covered very thinly with short black hair."

The figure represents the ears fringed with longer hair, and the tail covered with longer hair and reaching two thirds of the distance to the hocks.

The following names have been applied to this species:—

The double-horned Rhinoceros of Sumatra, Bell. Phil. Trans. 1793, p. 3, t. 2 (animal), t. 3 & 4 (skull); Home, Phil. Trans. 1821, p. 270, t. 21 (skeleton), and t. 22 (skull).

Rhinocéros bicorne de Sumatra, Cuvier, Oss. Foss. vol. ii. p. 27, t. 4, vol. iii. p. 49, t. 7 & t. 8. f. 8 (skull, from Bell).

Rhinoceros sumatranus, Raffles, Linn. Trans. xiii. p. 268; Müller, Verh. t. 35 (old and young); Blyth, P. Z. S. 1861, p. 306, 1862, p. 1; Journ. Asiat. Soc. of Bengal, xxxi. 1869, p. 151, t. 3.

Rhinoceros sumatrensis, Cuv. R. A.; Blainv. Ostéogr. t. 2 (skull), t. 7 (teeth); Anderson, P. Z. S. 1872, p. 129; Sclater, P. Z. S. 1872, p. 185.

Ceratorhinus sumatranus, Gray, P. Z. S. 1867, p. 1021; Cat. B. M. p. 313.

The Sumatran or *Hairy Rhinoceros*, Tegetmeier, 'Field,' March 16, 1872.

The Sumatran Rhinoceros, P. L. S. 'Nature,' March 18, 1872, p. 427, f. 1.

Hairy Rhinoceros from Chittagong, Buckland, 'Land and Water,' August 10, 1872.

Rhinoceros lasiotis, Sclater, *fide* Buckland, 'Land and Water,' August 10, 1872.

Hab. Chittagong and Sumatra.

I cannot conceive how the idea originated of giving another name to this species.

The length of the hairs on the margin of the ears appears to vary in the different specimens; and those in the specimen in the Zoological Gardens appear to be much longer than usual. Thus Dr. Anderson states that in the adult males and females from Burmah the margin of the ears is fringed with strong, erect, black hairs tipped with brown, almost an inch or rather more in length; but in this individual the hairs are nearly 5 inches long (P. Z. S. 1872, p. 130), so that the character from which it has been named may be only an individual peculiarity.

The species from Malacca has the hair on the body "thick, black, which stands erect like the hog-mane of a horse;" and further on, Mr. Buckland says the hair is stiff like "hedgehog's bristles."

The skin is "very rough, the tail long and thin, and comes nearly to the hocks."

Hairy Rhinoceros from Malacca, Buckland, 'Land and Water,' Aug. 10, 1872.
Rhinoceros sumatrensis, Sclater, *fide* Buckland, 'Land and Water,' Aug. 10, 1872.
Rhinoceros sumatranus from Tavoy, Blyth, Journ. Asiat. Soc. Bengal, 1862, t. 4. f. 1 & 2 (skull).
Rhinoceros sumatranus from Tenasserim, Blyth, Journ. Asiat. Soc. Bengal, 1862, p. 156, t. 3. f. 1, 2, 3, & t. 4. f. 2 & 3.
Rhinoceros Crossii, Gray, P. Z. S. 1854, p. 250, fig. (horns).

Hab. Malacca (*Zool. Gard.*); Tavoy, northern frontier of Siam; Pegu (*Theobald, B. M.*).

I think, from Blyth's figure of the skull from Tavoy, that the name of *Ceratorhinus Crossii* should be attributed to this species.

It is clearly not the Sumatran *Ceratorhinus* figured and described by Bell, Müller, and other zoologists, who would not have overlooked the hedgehog-like bristles and long slender tail.

XXXI.—*Note on* Tethya muricata, *Bowerbank, and* Dorvillia agariciformis, *Kent.* By W. Saville Kent, F.Z.S., F.R.M.S., Geological Department, British Museum.

In Part I. of the 'Proceedings of the Zoological Society' for this year, just issued, Dr. Bowerbank comments upon a sponge described and figured by myself in the 'Transactions of the Royal Microscopical Society' for 1870, under the name of *Dorvillia agariciformis*, referring it to his hitherto manuscript species *Tethya muricata*. The singular mushroom-like form which suggested the specific title attached to this sponge in my description, Dr. Bowerbank thinks fit to regard as an abnormal and imperfect condition, and summarily disposes of it as a "mutilated specimen" of his own species, having "the upper portion evidently torn away from its basal one, causing the part described to assume a form very much like that of an Agaric." Referring next to the types of spicula figured in my plate, Dr. Bowerbank assumes that I have "fallen into the error of describing some of those organs (?) that do not belong to the species under consideration," and enumerates in consecutive order such ones as he condemns as being derived from extraneous sources.

Dr. Bowerbank's foregoing adverse criticisms being rather calculated to mislead those interested in the structure of the Spongiadæ, I feel it incumbent upon myself to reply briefly to them.

In the first place I must express the most unqualified dissent from Dr. Bowerbank's proposition that the specimen from which my description was derived is a "mutilated" one: another example, accompanying the individual figured, furnished the same characters; and the same may be said of a fine series obtained by Dr. Carpenter and Professor Wyville Thomson during their earlier dredging expeditions to the North Atlantic in H.M.S. 'Porcupine.' The last-named gentleman, singularly enough, independently adopted the same specific title of *agariciformis* for this remarkable sponge, in reference to its striking contour, while at the same time he further generically distinguished it by the title of *Tisiphonia.*

Had Dr. Bowerbank referred to his last year's volume of the 'Annals,' he would have discovered that in the January number I contribute additional remarks on this same sponge, discarding those spicula of the hexaradiate type objected to by himself as having been derived from contact with other species, and correlate it with the true Tethyadæ. The question now remains whether the form is identical with Dr. Bowerbank's *Tethya muricata*, or whether it must rank as distinct a species. In the former case Dr. Bowerbank's specific title will have to be expunged, as, until this last issue of the Zoological Society's 'Proceedings,' no recognizable diagnosis of *Tethya muricata* has been published. One or two of the spicula have been figured by its author in his "Physiology of the Spongiadæ" in the 'Philosophical Transactions' for 1858 and 1862, and in his 'Monograph of the British Spongiadæ,' published by the Ray Society, these being in both places referred to *Tethya muricata* of his own MS.; so vague a reference, however, is totally inadequate for the purpose of establishing it as a species. On the other hand, the evidence in favour of its being a well-established deep-sea form, closely allied to, but possessing constant characters of specific value distinct from Dr. Bowerbank's *T. muricata* is of the most satisfactory description. Both Professor Wyville Thomson's specimens and my own show in common the characteristic *agaricine* contour, and vary from all hitherto described Tethyadæ in the possession of the dependent fascicles of long anchoring spicula by means of which it rests secure on the treacherous surface of the yielding ooze which constitutes its habitat. Dr. Bowerbank has thought fit to assume that these dependent fascicles are "skeleton-fasciculi of the sponge drawn out of the basal portion". at the time of his supposed mutilation, an error of judgment only explicable by his over-anxiety to identify the species with his own. On equally slender grounds, because he cannot find them in his own example, he considers himself justified in condemning as "extraneous" in mine certain very characteristic three- and four-rayed tension-spicula of the sarcode, figured and alluded to in my description (M. M. J. 1870, pl. lxvi. figs. 16–18 and p. 294). Since perusing his comments I have reexamined carefully mounted sections of the sponge, and am perfectly satisfied as to the correctness of referring these spicula to the position already indicated, which again constitutes valuable evidence in support of its being a species perfectly distinct from Dr. Bowerbank's. It is also most satisfactory to remark that Prof. Wyville Thomson has detected these same types of spicula in his specimens and figured them in his unpublished plates, which have again been reproduced in Dr. Oscar Schmidt's 'Spongienfauna des atlantischen Gebietes,' where they may be readily recognized at pl. vi. fig. 12. The anchoring filaments in Prof. Thomson's specimens exceed mine in length and abundance.

The nomenclature of this sponge, which has proved itself a very "apple of discord" among spongologists of the day, will now admit of definite solution. Allowing, with Oscar Schmidt, that the character of the dependent anchoring filaments, in which it differs from all *Tethyæ* hitherto described, constitutes a modification and adaptation to its natural habitat, scarcely justifying its being promoted to the rank of a distinct genus, the generic title of *Tethya* is still retained, with the specific one of *agariciformis* already bestowed upon it by Professor Wyville Thomson and myself, the following being offered as a brief summary of its technical characters already more comprehensively treated of in the two journals here quoted.

Tethya agariciformis, Kent.

Dorvillia agariciformis, Kent, Monthly Microscopical Journal, December 1870, p. 293, pl. lxvi. (excepting figs. 10–12, 14, 15, & 19); Ann. & Mag. Nat. Hist. Jan. 1871, vol. vii. ser. 4. p. 37.

Tisiphonia agariciformis, Wyville Thomson, MS. Porcupine Exp. 1870.

Stellata agariciformis, Oscar Schmidt, Spongienfauna des atlantischen Gebietes, p. 68, pl. vi. fig. 12, 1870.

Wyvillethomsonia Wallichii (?), Perceval Wright, Quarterly Journal of Microscopical Science, p. 8, pl. ii. 1870*.
Not *Tethya muricata*, Bowerbank, Proc. Zool. Soc. p. 117, 1872.

Sponge subconical, agariciform, having an expanded upper portion or hood, at or around the summit of which are located the exhalent apertures or oscula, and a lower or basal portion bearing numerous fasciculi of attenuate acerate and anchorate spicula, the two regions being distinctly marked off from one another by the overlapping of the hood. Spicula of the skeleton large, fusiformi-acerate, expando-ternate, recurvato-ternate, and bifurcate expando-ternate; spicula of the sarcode abundant, minute attenuato-stellate, with occasional larger triradiate and quadriradiate types.

Hab. Atlantic, dredged at a depth of 500 fathoms and upwards.

XXXII.—*Description of* Hesperornis regalis, *with notices of four other new Species of Cretaceous Birds.* By Professor O. C. Marsh†.

The few remains of birds hitherto described from the Cretaceous deposits of this country, although of much interest, all pertained to comparatively small species, and belonged, apparently, to families still existing‡. It is fortunate, therefore, that the existence of a fossil bird so large and remarkable as the one that forms the subject of the present description should first be made known by the discovery of such important parts of a skeleton as to afford ample material for the determination of its affinities. This interesting discovery has already been announced in this Journal, and the name *Hesperornis regalis* proposed by the writer for the species thus represented§. The present paper is preliminary to a full description, with illustrations, now in course of preparation. The other species briefly described in this article are likewise of interest, as they add some new forms to the limited avian fauna heretofore found in the Cretaceous beds of the Atlantic coast.

Hesperornis regalis, gen. et sp. nov.

The remains of this species at present known consist of portions of one skeleton, including the nearly entire posterior limbs, from the femur to the terminal phalanges, parts of the pelvis, several cervical and caudal vertebræ, and numerous ribs, all in excellent preservation. Fragments of four other individuals were also found by the writer, which agree essentially with the corresponding parts of the more perfect skeleton. An examination of these various remains soon makes it evident that they represent a gigantic swimming bird, having its nearest living allies probably in the *Colymbidæ*, but differing widely in many respects from that group, and from all other known birds, recent and extinct.

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* Possibly the embryonic condition of *Tethya agariciformis*.

† From the 'American Journal of Science and Arts,' n. s. vol. iii. May, 1872.

‡ *Ibid.* vol. xlix. p. 205, March 1870.

§ *Ibid.* n. s. vol. iii. p. 56, January 1872; Ann. & Mag. Nat. Hist. April 1872, p. 326.

The femur is unusually short and stout, much flattened antero-posteriorly, and the shaft curved forward. It somewhat resembles in form the femur of *Colymbus torquatus*, Brünn., but the great trochanter is proportionally much less developed in a fore-and-aft direction, and the shaft is much more flattened. The tibia, or *tibia-tarsus*, is straight and elongated. Its proximal end has a moderately developed cnemial process, with an obtuse apex. The epicnemial ridge is prominent, and continued distally about one half the length of the shaft. The distal end of the tibia has on its anterior face no ossified supratendinal bridge, differing in this respect from all known aquatic birds. The fibula is well developed, and resembles that of the Divers.

The tarso-metatarsal bone is much compressed transversely, and resembles in its main features that of *Colymbus*. On its anterior face there is a deep groove between the third and fourth metatarsal elements, bounded on its outer margin by a prominent rounded ridge, which expands distally into the free articular end of the fourth metatarsal. This extremity projects far beyond the other two, and is double the size of either, thus showing a marked difference from any known recent or fossil birds. There is a shallow groove, also, between the second and third metatarsals, which, taken in connexion with the deeper one, made the specimen appear, while still in the rock, as if its main elements were separate. The second metatarsal is much shorter than the third or fourth; and its trochlear end resembles in shape and size that of the former. The existence of a hallux is indicated by an elongated oval indentation on the inner margin above the articular face of the second metatarsal. The free extremities of the metatarsals have the same oblique arrangement as in the *Colymbidæ*, to facilitate the forward stroke of the foot through the water. There are no canals, or even grooves, for tendons on the posterior face of the proximal end, as in the Divers and most other birds; but below this there is a broad shallow depression extending rather more than halfway to the distal extremity.

The phalanges of the large external toe are very peculiar, although an approach to the same structure is seen in the genus *Podiceps.* On the outer inferior margin they are all deeply excavated. The first, second, and third have, at their distal ends, a single oblique articular face on the inner half of the extremity; and the outer portion is produced into an elongated obtuse process, which fits into a corresponding cavity in the adjoining phalanx. This peculiar articulation prevents flexion except in one direction, and greatly increases the strength of the joints. The terminal phalanx of this toe was much compressed. The third or middle toe was greatly inferior to the fourth in size, and had slender compressed phalanges, which correspond essentially in their main features with those of modern Divers. The phalanges of the first and second toes of the present specimen are wanting.

Portions of the pelvis, found with the posterior limbs in three of the specimens, indicate that the ilia were separated from each other, and not very firmly ossified to the sacral vertebræ. The acetabulum was covered with a thick cushion of cartilage, as in *Apteryx*; and at its upper margin the anterior and posterior extensions of the ilia, if both existed, were disconnected, or unossified at their union.

The cervical and caudal vertebræ preserved present no features deserving of special mention in this preliminary notice. The latter are numerous, but apparently not much in excess of those in some modern birds. Unfortunately, no portions of the skull were recovered. The femur and tibia have very thick compact walls, but appear to have been more or less pneumatic. The tarso-metatarsals and the phalanges were nearly or quite solid.

	millims.
Length of right femur	98
Transverse diameter of proximal end	53
Diameter of articular head	18·5
Transverse diameter of shaft at middle	22
Antero-posterior diameter	19·2
Transverse diameter of distal end	53·5
Length of right tibia	316
Transverse diameter of proximal articulation	38
Length of cnemial process	22
Transverse diameter of shaft at middle	29
Transverse diameter of distal end	32
Antero-posterior extent of outer condyle	32
Antero-posterior extent of inner condyle	22
Length of right tarso-metatarsal	137
Length to distal end of third metatarsal	130
Length to distal end of second metatarsal	116
Transverse diameter of proximal articulation	36

	millims.
Least transverse diameter of shaft	15
Transverse diameter of distal end of fourth metatarsal	16
Transverse diameter of third metatarsal	8·5
Transverse diameter of second metatarsal	8
Length of proximal phalanx of fourth toe	45
Length of second phalanx	39·5
Length of third phalanx	40
Length of proximal phalanx of third toe	41

The various remains of the present species already discovered belonged to five individuals, which differed but little in size or in any important particular. Taking the great Northern Diver (*Colymbus torquatus*, Brünn.) as a standard of comparison for the portions that are wanting, the skeleton of *Hesperornis regalis* would measure about 5 feet 9 inches from the apex of the bill to the extremities of the toes.

The affinities of *Hesperornis* have already been mentioned. The characters given in the above description show plainly that, although a comprehensive type, it belongs to the Palmipedes; and while most nearly allied to the *Colymbidæ*, it still differs so widely from that group in the structure of the pelvis and posterior limbs as to demand a place in at least a separate family, which may be called *Hesperornidæ*.

All the remains of the species now known were found by the writer, last summer, in the grey shale of the upper Cretaceous, near the Smoky-Hill River, in Western Kansas.

Graculavus velox, gen. et sp. nov.

Among the vertebrate remains in the Yale Museum, from the Cretaceous greensand of New Jersey, are fragments of the skeletons of two aquatic birds, which apparently belong to the same genus, although to quite distinct species. Both of these differ essentially from all recent birds, but are evidently most nearly allied to the Cormorants. The largest of these birds, to which the above specific name may be given, is mainly represented, at present, by the proximal half of a left humerus, in perfect preservation, and hence a very characteristic specimen. In its general features this humerus resembles that of the Common Cormorant (*Graculus carbo*, Linn.), although indicating a somewhat smaller species. The articular head is much more compressed transversely, its apex is more prominent, and its anconal margin is strongly deflected. The median ridge on the anconal side, below the head, is rounded instead of angular, and the ulnar crest is much less produced distally.

	millims.
Greatest diameter of proximal end of humerus	23·75
Vertical diameter of articular head	13
Transverse diameter	6
Proximal extension of head beyond ulnar crest	4·6
Least diameter of shaft below proximal extremity	6

The specimens on which this species is based were found by John G. Meirs, Esq., at Hornerstown, New Jersey, in the greensand of the upper Cretaceous, and by him presented to the museum of Yale College.

Graculavus pumilus, sp. nov.

The present species, which is hardly more than one third the size of the preceding, is likewise represented by the proximal end of a humerus, as well as by some other characteristic remains. The articular head in this specimen is equally compressed, and shows the same prominent apex, but is without the anconal deflection which distinguishes the larger species. The lower half of the head is narrower transversely, and separated from the internal trochanter by a wider notch. The median ridge, moreover, on the anconal face is much more acute.

	millims.
Greatest diameter of proximal end of humerus	13·25
Vertical diameter of articular head	8
Transverse diameter	4
Least diameter of shaft below proximal end	3·1
Greatest diameter of metacarpal at distal end	5·5
Least diameter	3·75

The known remains of this species are from the same locality and geological horizon as the preceding, and were also discovered by John G. Meirs, Esq.

Graculavus anceps, sp. nov.

The only fossil bird-remain secured during the explorations of the Yale-College party of 1870 in the Cretaceous beds of Kansas, although special search for them was made, was the distal extremity of a left metacarpal, which is so well preserved and so characteristic a part of the skeleton, that it indicates with considerable certainty the affinities of the bird to which it belonged. A careful comparison of this specimen with the corresponding bone in recent birds has made it apparent that the species was a near ally of the Cormorants; and it may therefore be referred provisionally to the genus *Graculavus*, until further discoveries determine its position more accurately. The specimen implies a species about the size of the Violet-green Cormorant (*Graculavus violaceus*, Gray), of the Pacific coast, and one somewhat larger than *Graculavus velox*, described above. From the metacarpal of the former it differs essentially in having the articular face for the external digit broader and nearly flat, the face for the small inner digit considerably smaller and oval in outline, and the intervening tubercle much more prominent.

	millims.
Greatest diameter of distal end	6·75
Least diameter of distal end	4·5
Transverse diameter of outer articular face	5
Vertical diameter	2·25

This specimen was found by the writer in the grey Upper Cretaceous shale, on the north fork of the Smoky-Hill River, in Western Kansas.

Palæotringa vagans, sp. nov.

The existence of a new Wading-bird in the Cretaceous greensand of New Jersey is plainly shown by an interesting fossil recently presented to the Yale Museum. The specimen is the greater portion of the shaft and distal end of a left tibia, somewhat injured, but with its more characteristic portions still preserved. It indicates a bird somewhat smaller than *Palæotringa littoralis*, described by the writer from the same locality*, but is probably a closely allied form. From the tibia of that species, the present specimen may readily be distinguished by the proportionally more narrow and shallow tendinal canal, on the anterior face of the distal end, and by the more depressed supratendinal bridge. The trochlear surface also, on the posterior side, contracts more rapidly, and at its superior margin passes directly, and not abruptly, into the shaft.

	millims.
Length of portion preserved	62
Approximate width of condyles in front	8
Width of bridge at centre	2·15
Transverse diameter of lower outlet	1·5
Transverse diameter of shaft where broken	5
Antero-posterior diameter	4

This unique specimen was discovered at Hornerstown, New Jersey, about ten feet below the surface of the marl, and was presented to the Yale Museum by John G. Meirs, Esq.

Yale College, Newhaven, April 10th, 1872.

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* Silliman's Journal, vol. xlix. p. 208, March 1870.

XXXIII.—*On the Genera* Manouria *and* Scapia.

By Dr. J. E. Gray, F.R.S. &c.

Dr. Anderson, in the just published part of the 'Proceedings of the Zoological Society' for 1872, has written a paper to prove that *Testudo Phayrei*, the type of the genus *Scapia*, and *Testudo emys*, the type of the genus *Manouria*, are only varieties or sexes of the same species, and has illustrated it with eight figures of the sternum of different specimens (pp. 134 to 137)—five belonging to *Scapia*, and the other three to *Manouria*. There is a slight modification in the form of the pectoral plates in the different specimens; but I do not think that, either in the plates or text, he proves the identity of the two genera, which doubtless are allied, and which, in the 'Supplement to the Catalogue of Shield Reptiles,' I have placed together in the same group of land-tortoises. And I do not think that he has proved his case, as it would be very unlike all that was previously known of the form of the pectoral shields in Tortoises.

Because the three specimens of *Manouria* which Dr. Anderson examined have the sternum concave, and his five specimens of *Testudo Phayrei* have it flat, he concluded that the former were the male and the latter the female of the same species, which he calls *Testudo emys*; and he gives a number of names as its synonyms, without defining which of them belong to the male and which to the female. I think if he had done so he would have avoided that mistake.

1. *Testudo emys*, described by Müller and Schlegel in Verhand. Nat. Gesch. Nederl. Ind. Rept. 1839, xliv. pp. 30, 34, tab. 4, the type of the species of *Manouria*, has a flat sternum, and is, according to Dr. Anderson's theory, a female.

2. The specimens in the British Museum, which are described and figured under the name of *Manouria fusca* (Shield Rept. p. 16. pl. 3), being the types of that species, also the specimen said to have come from Australia with the animal figured in the Proc. Zool. Soc. 1860, p. 395, t. 31. have a flat sternum, and are, for the same reason, females according to Dr. Anderson.

3. Leconte, who describes the species under the name of *Teleopus luxatus* (Philad. Proc. 1854, p. 187), does not mention the form of the sternum, which, I think, he most likely would have done if it had been concave.

I think we may therefore conclude that the two sexes of *Manouria* are known, that the specimens described by Schlegel, myself, and Leconte were females, and that those examined and figured by Dr. Anderson were males, according to his theory, and therefore both sexes of this genus are known.

Unfortunately I do not know of any specimens of *Testudo Phayrei* (the type of *Scapia*) being in Europe, and I have never had the opportunity of examining any; but as it appears that all the specimens that have been examined have a flat sternum, probably this species has the sternum flat in both sexes, as is the case in many land-tortoises, and the concavity of the sternum in males of *Manouria* would be a peculiarity of that genus.

Until the skull on which *Scapia* was founded was determined to be the skull of *Testudo Phayrei*, it was not known that the animal was so like that of *Manouria*; but since that time the two genera have been arranged in a special section (see Appendix to Catal. Shield Reptiles, 1872, p. 7). The animals of both resemble that of *Testudo sulcata* of Africa in form and in the scales on the legs and thighs; but that has only a single caudal plate and a shorter head.

XXXIV.—*On* Trionyx gangeticus, *Cuvier*, Trionyx hurum, *B.H. and Dr. Gray*. By Dr. ANDERSON, Calcutta.

DR. GRAY'S characteristic reply[*] to my strictures[†] on his understanding of the two species of Gangetic mud-tortoises seems to indicate that his present knowledge of these species, instead of being an advance on his 'Synopsis Reptilium,' is a relapse into confusion and unreliability. It is not surprising, therefore, that Dr. Gray and his friend conjointly were unable to follow the drift of my remarks. But, although I may not carry conviction to Dr. Gray's mind, I hope to be able, in the the following observations, to prove satisfactorily to unprejudiced minds that the skull figured by Cuvier under the name of *Trionyx gangeticus*, and referred by Dr. Gray to the *Trionyx hurum*[‡] of Buchanan Hamilton, described at p. 47 in the 'Synopsis Reptilium,' redescribed in the 'Catalogue of Shield Reptiles,' p. 66, under the name of *Trionyx gangeticus*, Cuvier, and again brought forward under the same name at

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[*] Ann. & Mag. Nat. Hist. ser. 4. no. 54, p. 473. [†] *Ibid.* no. 53, p. 382.

[‡] Dr. Gray, in his 'Synopsis Reptilium,' under the name of *T. hurum*, announces the brilliant discovery that "Cuvier's specimen appears to have a peculiarity, in the web between the second and third fingers of each foot being pierced with a hole;" and he further observes that these remarkable solutions of continuity "are not noticed in any of Dr. Hamilton's or General Hardwicke's figures from living animals." These holes, which evidently suggest to Dr. Gray's mind a wide and interesting field for further research, are made by the fishermen, who pass a cord through them and tie the feet together to prevent the animals escaping!

p. 97 in the Supplement to the latter work, is not the skull of that species.

The confusion that exists in Dr. Gray's Catalogues regarding the foregoing species (*T. hurum*) and his so-called *Trionyx javanicus*, Schweigger, MS., 'Illustrations of Indian Zoology,' (*T. javanicus*, Geoff.) 'Synopsis Reptilium,' p. 48, and 'Cat. Shield Rept.' p. 67, and *Potamochelys stellata*, Geoff., 'Suppl. Cat. Shield Rept.' p. 104, is alone explicable on the justifiable supposition that Dr. Gray is more anxious to catalogue the specimens under his charge than to work out their natural affinities by a careful consideration of the characters of the materials at his disposal. It would be well if Dr. Gray would carefully ponder the admirable advice which was so ably tendered to him by M. Brunner de Wattenwyl*, and remember that "les espèces sont des entités de la nature dont l'observation est du domaine de la philosophie."

The pernicious practice of creating new genera on characters derived exclusively from single skulls or from drawings of skulls without any knowledge whatever of the animals that yielded them, has resulted in this, that we find animals described by Dr. Gray in his Catalogues with their skulls and tails allocated in widely apart genera. The confused maze of synonyms which this practice has elaborated can be better imagined than described.

The facts connected with the two Gangetic mud-tortoises are these:—Dr. Gray's figure in the 'Illustrations of Indian Zoology,' bearing the name *Trionyx javanicus*, Schweigger, MS., represents the most prevalent species. Its skull is identical with the skull figured by Dr. Gray at pl. xlii. fig. 1 of his 'Catalogue of Shield Reptiles,' and which is there correctly named *Trionyx gangeticus*. This skull, however, is referred by Dr. Gray to the other species of Gangetic mud-tortoises, which was originally described by him in his 'Synopsis Reptilium,' p. 47, under the name *Trionyx hurum*, but which in his 'Suppl. to the Cat. of Shield Rept.' p. 97, is reproduced as *T. gangeticus*, Cuvier. This species (*T. hurum*), however, does not yield a skull like the skull figured by Cuvier as *T. gangeticus*; but if Dr. Gray will turn to pl. xlii. fig. 2 of his 'Cat. of Shield Rept.' he will find a skull figured, but without a name, which is very closely allied to the skull of *T. hurum*. The differences that exist between the skulls there figured indicate those that exist between *Trionyx gangeticus* and *Trionyx hurum*. But, although it is impossible to separate generically the skulls figured on that plate, Dr. Gray makes the unguarded statement that the two mud-tortoises of the Ganges, in question, belong to two genera. It should be borne in mind, however, that Dr. Gray has no practical acquaintance with the skull of his *T. javanicus*, Geoff., which is the last name but one which he has adopted for the *Testudo gotaghol* of Buchanan Hamilton, and which he named in the 'Illustrations of Indian Zoology' *Trionyx javanicus*, Schweigger, although he now states that Schweigger "never uses such a name." In the 'Synopsis Reptilium,' p. 48, and in the 'Catalogue of Shield Reptiles,' p. 67, the same species appears under the name *T. javanicus*, Geoff.; but Dr. Gray's knowledge of the species had apparently undergone a change in the interval between the publication of the Catalogue and its Supplement, because in the latter (p. 104) the species is brought on the stage as *Potamochelys stellata*, Geoff.

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* Rev. et Mag. de Zoologie, Mars 1870.

Dr. Gray remarks of the skull of *Emyda punctata* (Suppl. Cat. Sh. Rept. p. 117) that it is very like that of *Potamochelys*. I have before me a skull which I removed with my own hands from an adult specimen of the common yellow-spotted *Emyda* of the Ganges. This skull, although it is larger than Dr. Gray's figure of *Potamochelys stellata*, Geoff., I am prepared to prove is generically identical with the skull which that figure represents; in other words, Dr. Gray's figure of the skull of *Potamochelys stellata*, Geoff., is the skull of an *Emyda* closely allied to *Emyda punctata*.

It is to be desired that Dr. Gray should state whence he obtained the figure of the skull of his so-called *Potamochelys stellata*, Geoff., because in writing of the species he distinctly states, "I have not been able to examine any skulls of it." Has Dr. Gray copied the skull from Prof. Wagler's figure without any acknowledgment, and without any grounds that justified him in referring the skull of an *Emyda* to the body of a true *Trionyx*, the skull of which had been already figured and described by Cuvier as *Trionyx gangeticus*?

The foregoing insight into the character of the 'Supplement to the Catalogue of Shield Reptiles in the Collection of the British Museum' is unfortunately not an isolated instance of the many inaccuracies which distinguish it. Only a very short time ago I pointed out that Dr. Gray's genera *Manouria* and *Scapia* refer to one animal, the shell constituting the former and the skull the latter genus, the two genera being the equivalent of the genus *Testudo*[*]! The correctness of what

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[*] A paper of mine appeared in this Journal, vol. viii. p. 324 (1871), under the misnomer, "On *Testudo Phayrei*, Theob. and Dr. Gray," whereas it should have been "On *Trionyx Phayrei*" &c. The whole internal evidence of the paper proved the absurdity of the title, which I believe was drawn out by the editors of the 'Annals.' [Whatever Dr. Anderson

I then stated has been allowed by Dr. Gray, as he has returned the skull of *Scapia Falconeri* to this museum on the strength of my representation.

Before concluding, I may observe that I have never asked Dr. Gray, on any occasion, for his opinion of Dr. Fleming, and that I never had the privilege, while a student, to be a regular member of Dr. Fleming's class; and under these circumstances I object to Dr. Gray's Chelonian method being applied to me.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

May 30, 1872.—George Biddell Airy, C.B., President, in the Chair.

"On the Structure and Development of the Skull of the Salmon (*Salmo salar*, L.)"* By William Kitchen Parker, F.R.S.

A few years ago Mr. Waterhouse Hawkins put into my hands some newly hatched salmon and also three of the first summer. Seeing their fitness for embryological research and the interest attaching to the formation of an osseous fish, I applied to my friends Messrs. Frank Buckland and Henry Lee, and these gentlemen most liberally supplied me with a large number of unhatched embryos and of the "fry" of this large fish.

My last subject, the frog, being fairly out of hand, I set myself last summer to this newer and more easy task,—more easy by far; for the translucency of the young salmon contrasts most favourably with the obscurity of the embryo frog.

I found that the two types at the time of hatching did not start fairly, but that the salmon had hastened to finish its *fourth stage* before emerging from the egg; this, however, is partly in consequence of the difference of the envelope in which the embryos are contained; for in the salmon this is a leathery "chorion," and in the frog a mere gelatinous bleb.

Moreover it soon became apparent that these two "Ichthyopsidans" are in no wise near akin to each other. In the very first stage, where there is an essential agreement, in one important particular they greatly disagree; for the embryo of the salmon has two arches in front of its mouth, while the tadpole has but one; there is also an additional gill-arch in the osseous fish.

In the earliest stage of the salmon worked out by me I found a

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may believe, and however absurd the Title, we can assure him it stands in his own hand-writing—at the head of the MS. The only alteration, fortunately, which I ventured to make was the substitution of a *P* for *p* in *Phayrei*.—W.F.]

* Being an abstract of the Bakerian Lecture.

much more distinct condition of the parts than in frogs at the same stage; the differentiation of the latter is obscure as compared with the fish, and this not merely because of the quantity of *pigmentum nigrum* in its tissues.

Then, in addition to other causes of obscuration, the mouth of the tadpole is strangely modified in harmony with its "suctorial" character and affinities (showing a remarkable affinity to the mouth of a lamprey), so that a whole system of cartilages has to be eliminated from the lips before the mouth (proper) can be understood. The labial system is slightly and slowly developed in the salmon, and its mouth is thus much more in harmony with that of the embryo reptile or bird than with that of the tadpole.

After the simple stage is passed, the development of the facial arches is very different in the two types—as different, indeed, as in any two possible examples that could be given in the whole vertebrate group.

The facial arches behind the mouth now undergo segmentation—first the hyoid, and then the mandibular. The hyoid is cloven from top to bottom and also has a single distal piece separated off.

At this stage we get an explanation of what is seen in certain rays, where the hyoid suspensorium is permanently double; and also ascertain that this second postoral arch, which retains the anterior piece in relation to the skull as the great "hyomandibular" pier, does not need the *saw* of the transcendentalist to put it into proper relation to its surroundings. Nature's invisible *wedge* has done what was needed, and the supposed *double rib* turns out to be *half* a visceral arch. On the whole, this second stage is extremely "Plagiostomous," for the details of which I must refer to the main paper.

While in the egg the head of the embryo is flattened, and so twisted that one of the eyes (it may be the left or the right) looks upwards towards the "chorion," the other having a *visceral* direction.

The facial bars, at first having all a simple sigmoid form, rapidly change towards the time of hatching; and when the head gets free, the cerebral vesicles speedily swell, taking on the form so familiar to the embryologist; and the head now gains the "mesocephalic flexure."

After this an approach is made to the Teleostean type of structure; but this is not done at a stride. The intermediate condition is thoroughly "Ganoid," and, happily, comes in to explain the related structures of the *older* and *newer* "Orders." I am not aware that any stage of the heart or of the intestines shows either the many valves of the "aortic bulb" or the intestinal spiral valve; this must be seen to; yet if these never show themselves in the "fry" of the osseous fish, their absence does not affect the general skeletal morphology.

The salmon amongst fishes, like the fowl amongst birds, never attains to the greatest degree of special class-modification; it remains *subtypical*, with a dentigerous maxillary, a ductus pneumaticus, a very *chondrosteous* state of the skull, and a very heterocercal tail.

Yet, from an ichthyological point of view, this fish is an immense height above the Sharks and Rays, and is far in advance, as a fish, of the whole group of "Ganoids."

The results of the *gradational* study of the fish-forms by the zoologist, and of their *secular* study by the palæontologist, are both in harmony with morphological facts. Although the light obtained is but as the first streak of dawn, yet it is a pleasant light, and quite sufficient to show each kind of worker where and how to renew his own special toil.

I cannot close this brief abstract without remarking that my researches in these, the highest types of animals, seem to me to be in perfect accordance with the results obtained by long study of the very lowest, the Rhizopods—namely, that they both yield increasing evidence in favour of the doctrine of Evolution.

Researches of this kind show what the life-processes can accomplish in the history of one individual animal, and also that the morphological steps and stages are not arbitrary, but take place in a manner in accordance with all that has of late been revealed to us of the gradation of types in the ages that are past.

June 20, 1872.—Sir James Paget, Bart., D.C.L., Vice-President, in the Chair.

"Notice of further Researches among the Plants of the Coal-measures." By Professor W. C. Williamson, F.R.S. (in a Letter to Dr. Sharpey, Sec. R.S.

Fallowfield, May 3, 1872.

My dear Dr. Sharpey,—In my memoir on Calamites, published in the last volume of the 'Philosophical Transactions,' I gave two figures of sections of a plant (plate 25. fig. 16 and plate 28. fig. 39) supposed to be a Calamite, but respecting the Calamitean nature of which I expressed my doubts in a note at the foot of page 488. I have now got numerous examples of this plant; and it proves, as I surmised, to belong to a distinct type. It has a branching stem, *not* jointed, and having a remarkable pith. Since the latter organ, when divided transversely, gives a star-shaped section, closely resembling that of a Calamite, except that it has not been fistular, I propose to give to the plant the generic name of *Astromyelon*. I have further examined a series of curious stems which I described briefly at the Edinburgh Meeting of the British Association under the name of *Dictyoxylon radicans*; this plant I also find must be placed in a new genus. It is characterized by possessing an exogenous, woody, branching stem, composed of reticulated vessels. It has no pith; and its bark consists of cells arranged in columns perpendicular to its surface. I think it not improbable that this has been the subterranean axis of some other plant, since I have succeeded in tracing its ultimate subdivisions into rootlets. I propose for the present to recognize it by the generic name of *Amyelon*. My specimens of this plant are very numerous, some of them having been kindly supplied to me by Messrs. Butterworth and Whittaker, of Oldham.

They may prove to be rhizomes and roots of the Asterophyllite described in my last letter to you.

Of this last genus I have just got an additional number of exquisite examples, *showing not only the nodes but verticils of the linear leaves so characteristic of the plant.* These specimens place the correctness of my previous inference beyond all possibility of doubt, and finally settle the point that *Asterophyllites* is *not* the branch and foliage of a Calamite, but an altogether distinct type of vegetation having an internal organization peculiarly its own. This organization is identical in every essential point with that of my *Volkmannia Dawsoni* already referred to in my previous letter, and which I now do not hesitate to designate *Asterophyllites Dawsoni.* The peculiar triquetrous form of the young vascular axis of this genus is too remarkable and too distinct from that of all other Carboniferous types to be mistaken for any of them, and especially for that of Calamites, with which it has not one single feature of real affinity.

I have also obtained, partly through the assistance of Messrs. Butterworth and Whittaker, but especially the latter, an instructive series of specimens of the genus *Zygopteris*, which has recently been made the subject of an important memoir by M. B. Renault, published in tome xii. of the 'Annales des Sciences Naturelles.' Our Lancashire specimens are of the type which he describes under the name of *Z. Lacattii.* The French savant has found these plants, in one instance, connected as petioles to a rhizome which he believes to be that of a fern. Our specimens supply some information additional to that published by M. Renault: they appear to me to sustain his idea that they are petioles; and I have traced in them the origin of the two vascular bundles which he refers to as pores existing in the bark. I find much reason for concluding that they are, as he surmises, the vessels going to the secondary rachis of the pinnules. Our Lancashire specimens are covered with sparse but very distinct hairs that, unlike the ramentaceous form common amongst ferns, are perfectly cylindrical. Whilst I am thus inclined to express my conviction that M. Renault is correct in his views respecting *Zygopteris*, I find it increasingly difficult to distinguish fragments of ferns from those of Lycopods, as also fragments of petioles from those of roots.

Mr. Nield and Mr. Whittaker, of Oldham, have just supplied me with two magnificent stems of Calamites of large size. The pith is absent from both, except some slight traces at the node of one of the specimens. I find on dissecting these matured stems that the remarkable arrangements of the vascular structure seen in plate 23. figure 2 of my memoir on Calamites almost entirely disappear in the more external of the exogenous growths. The conspicuous vertical laminæ of cellular parenchyma (my primary medullary rays), which separate the woody wedges, rapidly diminish in size as they proceed from within outwards, becoming more or less like the *secondary* or ordinary medullary rays represented in my fig. 5. Many of them, however, retain the evidence of their primary medullary origin in their unusual length, and in consisting of two, or even three, vertical series of cells instead of one, as is usual with the secondary rays. The vessels pursue their longitudinal course across the node undeflected in any direction, save where they bend aside to allow the passage outwards of vascular bundles going off to the aërial branches*, as represented in my figures 13 and 38. Thus in the exterior parts of these large stems the ligneous zone exhibits little or no indication of the presence of a node, except what these divergent bundles afford. I find that these bundles slightly increase in size as they proceed from within outwards, showing that they share in the exogenous additions made to the exterior of the ligneous zone; in one of my stems that zone has a circumference of seven inches, and in the other of six and three quarters. It is in the former one that I find the nodal bundles; but I have not seen one of these organs whose actual diameter exceeds three sixteenths of an inch, confirming my previous statements respecting the comparatively small size of the aërial branches. As in my previously described examples, these bases of branches exhibit no separation of the vessels into a circle of wedges like those of the parent stem. The persistent growth of the vascular bundles just described seems to indicate more permanent relations between them and the central stem than I once thought probable. There appears to be a close approximation to uniformity in the number of the woody wedges of these large stems; one of mine contains 85, and the other 83 such. Mr. Binney counted 73 in his large specimen (*loc. cit.* pl. 2. fig. 1). In the thin, young woody cylinder represented in my fig. 19, the mean diameter of which was slightly over an inch, the number was also about 80. This close resemblance between stems so different in age and size again illustrates another of my previous statements, viz. that age produces no increase in the number of the woody wedges, but that each one of the latter enlarges by successive additions to its peripheral portions of new laminæ, which latter partly fill up the increasing area of the enlarging circle, and partly encroach upon the primary medullary rays, as represented in my figure 17, in addition to some interstitial growth.

We thus learn that as the ligneous cylinder of a Calamite increased in age and size it gradually exhibited less and less of the Calamitean peculiarities seen in young stems; its external portions assumed a generalized, unsulcated form, which recurs with remarkable uniformity in several otherwise different plants of the Coal-measures.

Amongst the Burntisland fossils sent to me by Mr. Grieve I find two very curious stems, probably of the same general nature as *Zygopteris*. Both have a dense outer cortical layer, with vascular bundles in the interior. In the simpler of these plants the transverse section of this bundle is crescentic; but in the concave border of the crescent are two small projecting capes dividing it into three minor bays (fig. 2). In the other the vascular axis is a double one, lodged in a somewhat elliptical stem: one of these is a simple crescent, the concavity of which is directed inwards; the other has a very elegant transverse section (fig. 1). It is shaped like a dumb-bell, one head of which rests within the concavity of the crescentic bundle, and the other turns in the opposite direction; at each of these two extremities the margin of the dumb-bell is excavated into a small bay, as if a vertical canal had existed at each point; but these seem to have been merely columns of cellular tissue encroaching upon the rounded outline of the vascular structures. I propose provisionally to recognize these two forms under the generic name of *Arpexylon*.

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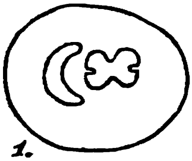
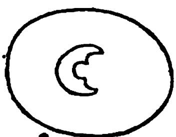
* This condition is very correctly represented in plate 3. fig. 3 of Mr. Binney's memoir on Calamites (Palæont. Soc.).



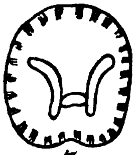
1.

Fig. 1. *Arpexylon duplex.*



2.

Fig. 2. *Arpexylon simplex.*



3.

Fig. 3. *Edraxylon.*

Fig. 3 represents a stem or petiole in which the section of the vascular bundle presents the form of a chair or seat, and to which I propose to assign the name *Edraxylon*. This form exhibits numerous modifications of the pattern represented in the outline, down to a single central vascular bundle. It may prove to belong to *Dictyoxylon Oldhamium*.

MISCELLANEOUS.

On the Specific Name of the Black Redstart.

By Alfred Newton, M.A., F.R.S.

Dr. Gray's note "On the name *Tethya* and its Varieties of Spelling" in the last Number of the 'Annals' (p. 150) reminds me of a still greater diversity which has long existed among ornithologists as to the spelling of a name which at first sight looks as if it might have something in common with that of *Tethya*.

In 1769 Scopoli (Annus I. Historico-naturalis, p. 157) characterized a now well-known bird as "*Sylvia tithys*," with a reference to "*Linn.* S. N. XI. n. 23." The eleventh edition of Linnæus's great work is not at present accessible to me; but it was notoriously a mere reprint of his tenth edition (1758), of which a copy is now before me. Here (i. p. 187) we have the 23rd species of the genus *Motacilla* designated "*Titys*," and a reference to "*Fn. svec.* 227;" but this, as Linnæus in his twelfth edition (i. p. 335) allowed, was the female of his *M. phœnicurus*, and Scopoli was unconsciously the first to give a binomial title to the species we now know as the Black Redstart; in so doing, however, he misspelt the word, introducing an *h* into the name, and in consequence opened a door for a great number of future errors, while puzzling naturalists to account for it.

Linnæus, in his mode of spelling, copied Gesner, who in 1555 (Hist. Anim. iii. p. 719) has *titys*; but the latter also mentions that

Dionysius writes *titis*; and this seems to be the correct form of the word. Turning to Liddell and Scott's 'Lexicon,' based on that of Passow, we have:—

"*τῖτίς, ἴδος, ἡ*, like *πιπώ*, a small chirping bird, Phot."

Now Photius flourished somewhere about A.D. 850; and looking to his dictionary, printed in 1822 from the Gale MS., and edited by Porson and Bekker, we see (ii. p. 592):—

"*τιτίς: βραχὺ ὀρνίθιον· σημαίνει καὶ τὸ γυναικεῖον αἰδοῖον· τιτὶς καὶ ἡ κέρκος.*"

Stephanus also shows that *titis* is the correct form. In his 'Thesaurus' (ed. Paris: 1848–1854, vii. p. 2241) we have "*τιτὶς, ἰδος, ἡ, avicula,*" &c., and the sentence "*ἐμβιβάζεσθαι εἰς τὰς καλουμένας τιτίδας,*" which settles the matter. Moreover he adds "*τίτυς* in vv. LL. affertur pro *τίτις*."

Photius and others after him derive the word *τιτίς* from *τιτίζειν*, otherwise written *πιπίζειν*, to chirp.

Hence we may conclude that *titis* was originally a general name for a small chirping bird, that in time it became specially applied to some bird with a red tail, that as such it had one or more figurative meanings (in the sentence above quoted we might perhaps translate it by "Firetail"), concerning which we need not now trouble ourselves, and that *titys* is an erroneous form, which has been still further corrupted into *tithys*, *tethys*, *thytis*, and I know not how many other misspellings.

Lastly, I may perhaps venture to hint that the root of *titis* exists in the prefix "Tit" of the English "Titlark" and "Titmouse," and the first syllable of the Icelandic *Titlingur*, where it retains its primitive generalized meaning.

In excuse for occupying all this space, I may mention that naturalists like Hemprich and Ehrenberg (Symb. Phys. fol. *bb*) and Von Heuglin (Orn. Nordost-Afr. i. p. 334) have not thought it beneath them to attempt an explanation of this word, referring it to *τίτης*, *ultor*, with which it has nothing whatever to do.

3 August, 1872.

New Names for a long-known Lepidopteron. By C. Ritsema.

In the last Number of the 'Annals,' Mr. A. G. Butler describes and represents a new genus and species of the family Notodontidæ. The genus is named *Tarsolepis*, the species *T. remicauda*.

The same insect, however, was figured as far back as 1806 by J. Hübner, in the second volume (plate 197) of his 'Sammlung exotischer Schmetterlinge,' under the name of *Crino Sommeri*, and as belonging to the Noctuæ genuinæ. Herrich-Schäffer (Sammlung neuer oder wenig bekannter ausser-europäischer Schmetterlinge, p. 11) changed the generic name as used before into *Crinodes*, and placed the insect in the family Notodontina. Walker, on the other hand, in his 'List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,' part xiv. (1858), p. 1346, places the genus

Crino, Hübner, in the Noctuide family Ophiusidæ, which, however, is rectified in the 'Stettiner entomologische Zeitung' for 1862 (p. 477) by K. Dietrich, who regards it, and most justly, as a Notodontide genus, nearly allied to the genera *Phalera*, H.-Sch., and *Datana*, Walk.

I have seen five specimens of *Crinodes Sommeri*, Hübn.—four females in the collection of the Royal Museum at Leiden (placed under the name *bilaminata*, De Haan, I. L., in the genus *Nystalea*, Gn., at present also a Notodontide genus), and one male in Mr. P. C. T. Snellen's collection at Rotterdam, all sent over from Java. Walker (*l. c.* p. 1348) makes mention of a specimen from Rio Janeiro in Mr. Fry's collection.

Leiden, August 10, 1872.

Note on Intelligence in Monkeys. By Prof. Cope.

I have two species of *Cebus* in my study, *C. capucinus*, and a half-grown *C. apella*. The former displays the usual traits of monkey ingenuity. He is an admirable catcher, seldom missing any thing, from a large brush to a grain, using two hands or one. His cage-door is fastened by two hooks, and these are kept in their places by nails driven in behind them. He generally finds means, sooner or later, to draw out the nails, unhook the hooks, and get free. He then occupies himself in breaking up various objects and examining their interior appearances, no doubt in search of food. To prevent his escape I fastened him by a leather strap to the slats of the cage; but he soon untied the knot, and then relieved himself of the strap by cutting and drawing out the threads which held the flap for the buckle. He then used the strap in a novel way. He was accustomed to catch his food (bread, potatoes, fruit, &c.), with his hands when thrown to him; sometimes the pieces fell short three or four feet. One day he seized his strap and began to throw it at the food, retaining his hold of one end. He took pretty correct aim, and finally drew the pieces to within reach of his hand. This performance he constantly repeats, hooking and pulling the articles to him in turns and loops of the strap. Sometimes he loses his hold of the strap. If the poker is handed him he uses that with some skill for the recovery of the strap. When this is drawn in, he secures his food as before. Here is an act of intelligence which must have been originated by some monkey, since no lower or ancestral type of mammals possess the hands necessary for its accomplishment. Whether originated by Jack, or by some ancestor of the forest who used vines for the same purpose, cannot be readily ascertained.

After a punishment the animal would only exert himself in this way when not watched; as soon as an eye was directed to him he would cease. In this he displayed distrust. He also usually exhibited the disposition to accumulate, to be quite superior to hunger; thus he always appropriated all the food within reach before beginning to eat. When different pieces were offered to him, he transferred the first to his hind feet to make room for more; then filled his mouth and hands, and concealed portions behind him. With a large piece in his hands he would pick the hand of his master clean before using his own, which he was sure of.—*Proc. Acad. Nat. Sci.* April 1872, p. 40.

Curious Habit of a Snake. By Mr. Cope.

Mr. Cope made the following remarks:—I had for some time a specimen of *Cyclophis æstivus*, received from Fort Macon, N. C., through the kindness of Dr. Yarrow, living in a Wardian case. The slender form of this snake, and its beautiful green and yellow colours, have led to the opinion that it is of arboreal or bush-loving habits. It never exhibited such in confinement, however, and instead of climbing over the Caladia, ferns, &c., lived mostly under ground. It had a curious habit of projecting its head and two or three inches of its body above the ground, and holding them for hours rigidly in a fixed attitude. In this position it resembled very closely a sprout or shoot of some green succulent plant, and might readily be mistaken for such by small animals.—*Ibid.*

Eggs and newly hatched Young of Ixodes Dugesii *and* Argas reflexus.
By George Gulliver, F.R.S.

Seeing the dreadful ravages committed of late by the *Ixodes* on sheep and pheasants, and the novelty of *Argas* as a British Arachnid (Ann. Nat. Hist. March 1872), any contribution towards the economy of these Acarina may be important or interesting. And now we are able to determine pretty nearly the time and manner in which both these species are hatched. At the meeting of the East Kent Natural-History Society at Canterbury, August 15, 1872, my son exhibited (as reported in the 'Kentish Gazette' newspaper four days afterwards) specimens of the eggs and recently hatched young of both these so-called ticks. The eggs of the *Ixodes* were smooth, regularly oval, about $\frac{1}{40}$ of an inch long, and $\frac{1}{60}$ broad, and of a shining chocolate colour; those of the *Argas* were larger, occasionally suboval, but the majority of them globular, about $\frac{1}{34}$ of an inch in diameter, of a greyish colour, and slightly rough on the surface. Adults of the *Ixodes* and *Argas* were confined in separate boxes early in June, and were seen to be lively and unchanged at the end of that month; but the eggs were laid in clumps some time afterwards, and on the 1st of August most of them, both of *Ixodes* and *Argas*, were found to be hatched. The young broods of both species were in most respects miniatures of their parents—only, as is already known of some other Acarina, with but six legs—and running about with great activity; and the newly hatched specimens of *Argas* were hairy, especially at the hinder part, where there is a fringe of hairs. The *Ixodes* is very prolific. A single female confined in a pill-box produced no less than 143 eggs, of which, on August 9, all but six were found to be hatched, and the young swarm actively trying to escape from their prison. The egg-shells, both of *Ixodes* and *Argas*, are composed of tough chitine. The husbandmen, in trying to relieve their suffering flocks and to destroy the ticks, have employed men to pick them off the sheep, throwing the ticks on the ground; but this practice is now shown to be simply propagating the evil by sowing the pregnant vermin broadcast.

Canterbury, August 20, 1872.

On the Embryonic Form of the Gordii. By M. A. Villot.

The embryo of the *Gordii*, which has hitherto remained unknown, has no resemblance to the adult form. It is a microscopic cylindrical worm, scarcely 0·205 millim. in length, and 0·045 millim. in breadth, in which we may easily distinguish a head, a body, and a tail.

The head is as broad as the body and entirely retractile; it is armed with a triple circlet of stout prickles, and terminates in front in a sort of trunk or sucker. The trunk is rigid, owing to the four strong styles which serve it as a framework. The prickles of the first two rows (that is to say, those near the base of the trunk) are of the same form, arrangement, and size; they are six in each row, the upper ones slightly covering the lower ones; and they are partly inserted into a triangular sheath, which gives them the form of a lance-head. Those of the third row are implanted at the base of the head. They alternate with those of the first two rows, and do not resemble them either in number or in form; their sheath is nearly quadrilateral, and their free extremity is much longer; they are also stouter and more resistant; lastly, we count seven of them instead of six, as one of the sheaths bears two. The head, in its movements of protrusion and retraction, behaves like the trunk of the *Echinorhynchi*; it turns back upon itself from its apex to its base, and from its base to its apex, causing its prickles to describe an arc of 180 degrees. When it is out of the body, the points of the prickles are directed backwards; in the contrary case the opposite. Their arrangement is then completely inverted: the trunk, which was in front, is thrown completely to the back; then come successively the prickles of the first, second, and third rows, united in bundles and constituting with the trunk a solid rod in the centre of the body; the extremities of the prickles of the third row slightly project beyond the extremity of the body, which is then armed with a short but very resistant dart.

The body presents numerous transverse folds, very close together, and very regular, so that it might be thought to be composed of true rings.

The tail, which is a little narrower than the body, is separated from it by a deep constriction; it is also very distinctly annulated, and bears towards its posterior extremity, which is obtuse, four appendages—two very small ones in the centre, and two larger at the sides.

After its escape from the egg, when free in the water, where it is at first called upon to live, the embryo of the *Gordii* has not at its command any great means of locomotion. Its cylindrical and not very mobile tail cannot serve it for swimming. At the utmost it might make its way through the mud by means of the hooks with which its retractile head is armed. It must also be easily carried along by even the weakest current. Those which I kept in glass vessels finally adhered to the walls, and formed there, by their number, a sort of pulverulent coating. In the natural state they must fix themselves in the same manner to pebbles and the roots and stems of aquatic plants; and it is there that they lie in wait for the larvæ of which they are the predestined parasites.

This is not an hypothesis; for the experiment has been made. Having placed a certain number of the embryos in the presence of various larvæ of culiciform Tipularia (*Corethra*, *Tanypus*, *Chironomus*), I have had the satisfaction of seeing them encyst themselves. The little worm penetrates into these larvæ, whose integuments are but slightly resistant, by means of its cephalic armature, which it causes at first to project suddenly; its prickles becoming reversed catch in the tissues of the larva, fix themselves there, and allow the trunk to bury itself deeply: then it withdraws the whole, to recommence the same manœuvre. As soon as the embryo has found a resting-place to suit it, it remains motionless; then the fluids which bathe it all round become coagulated and form for it an investment which, by hardening, becomes a true cyst. This cyst, the outer surface of which seems to be covered with small irregular concretions, is at first transparent and exactly applied to the embryo; but if we reexamine it in a few days, we find that it has become brown and elongated, and that the embryo only occupies the anterior part of it, which probably is never completely closed. Thus the little parasite, after its encystation, still travels in the tissues of the larva, constantly elongating its cyst and leaving behind it an empty space, which becomes larger and larger, until the moment when itself passes into the larval state. Such are in fact the conditions of its existence; and such is the use of the complex armature which it has received from nature.

The *Gordii* are therefore subject, in the course of their development, not only to necessary migrations, but also to *complete metamorphoses*. This fact, which we were far from anticipating, shows that, as regards the first phases of evolution, there is no analogy between *Mermis* and *Gordius*, and that the latter, in the embryonic state, have a certain resemblance to the Acanthocephala.—*Comptes Rendus*, 5th August, 1872, p. 363.

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XXXV.—*On* Callograptus radicans, *a new Dendroid Graptolite.*

By JOHN HOPKINSON, F.G.S., F.R.M.S.

[Plate X.]

THE genus *Callograptus* belongs to a group of organisms which are frequently classed with the Graptolites, but which present sufficient points of difference to warrant their separation as a distinct sub-order, for which the name DENDROIDEA has been proposed by Prof. H. A. Nicholson. In it are included the genera *Ptilograptus*, *Dendrograptus*, *Callograptus*, and *Dictyonema*. These forms, while nearly allied to each other, differ considerably from the true graptolites. The slender chitinous rod or "virgula," from the invariable presence of which in the true graptolites Prof. Allman has recently proposed for them the name RHABDOPHORA, is not present in these forms; and the slender "radicle," forming in the true graptolites the proximal termination of the virgula, is also absent. The DENDROIDEA, all of which are branching forms, differ also from the RHABDOPHORA in their mode of branching, and there seems to be a slight difference in their hydrothecæ.

There is yet another and a very important point of difference between the two groups. The new species of *Callograptus*, which I propose to name *C. radicans*, seems to furnish conclusive evidence of the fixedness of the forms to which it belongs, while the slender tapering radicular process of the Rhabdophora shows that they could not have been similarly attached to foreign bodies.

CALLOGRAPTUS agrees with its near allies, *Dendrograptus* and *Dictyonema*, in having "a common trunk or stem, or growing in sessile groups of stipes from a common origin, without distinct bilateral arrangement of the parts," and also in having its hydrothecæ "in single series on one side of the stipes or branches, and arranged along a common canal or axis," and differs from them in having its branches "unfrequently and irregularly connected by transverse processes" (Hall).

CALLOGRAPTUS RADICANS has *a diffuse flabelliform polypary, with an elongated erect and robust hydrocaulus, terminating proximally in a spreading fibrous hydrorhiza.* The polypary, in the only specimen in which this rooting termination or hydrorhiza has been seen, is at least six inches long; and its extreme width, where the branches terminate distally, appears to have been about the same. The hydrorhiza covers a space about half an inch square, but is very irregular in shape. It appears as a series of interlacing or anastomosing fibres which must have formed a kind of network over the surface to which it adhered. The hydrocaulus or main stem is about 1-10th of an inch in width at its junction with the hydrorhiza, increasing to twice this width where the first indication of branching occurs, its length between these two points being exactly one inch. It has a striated surface and an irregularly crenate outline. The branches bifurcate frequently and continuously throughout their length, diverging only slightly at first; but after the first few bifurcations the whole polypary rapidly widens out, and towards its distal extremity the branches frequently diverge from each other at a wide angle. They vary from 1-50th to 1-30th of an inch in width, but, being much compressed, must have been originally of greater tenuity. They frequently anastomose; but this, as in *C. Salteri*, Hall, does not appear to be a constant character. Unfortunately the state of preservation in which this species occurs does not allow the form of its hydrothecæ to be distinctly made out. Some of the branches show minute oval impressions arranged in a single series along their centre, the longer diameter or major axis of the oval being parallel with the margins of the branches. These impressions, of which there are about twenty to the inch, most probably indicate the apertures of the hydrothecæ.

This species is very distinct from the two previously described species of *Callograptus*. It is much larger and more robust in all its parts than *C. elegans*, Hall; and its branches originate from the main stem in a very different manner. To *C. Salteri*, Hall, it is more nearly allied; but its branches bifurcate in a more irregular manner than in that species, they have not the same zigzag direction, and the whole polypary is more diffuse and irregular in form.

But the distinctive feature in the specimen of *Callograptus radicans* described above is its possession of a hydrorhiza, or rather, I should perhaps say, the *preservation* of its hydrorhiza; for the presence of this organ in a single specimen of one species should suffice to prove its former presence in all —to show, in fact, that it is an essential organ of the genus *Callograptus.*

From the imperfect manner in which these Silurian fossils are usually preserved, we cannot wonder that a delicate organ, whose function it was to attach to some other substance the more durable portion of the organism of which it formed a part, has not before been found in connexion with this portion. None of these dendroid graptolites has yet been found attached to any other body. Their proximal termination is usually imperfect, and often has an irregular margin as if it had been broken. Such fracture, when the polypary was severed from the substance to which it was attached, would most easily take place at the junction of the hydrocaulus with its hydrorhiza.

In the rocks in which graptolites occur, other fossils are seldom found; but in the graptolite beds from which this specimen was obtained a large *Conularia* (*C. Homfrayi*) abounds, and in a thin zone in which this and other species of *Callograptus* and *Dendrograptus* occur in profusion it is especially abundant. Upon this *Conularia,* which is sometimes covered with graptolites, and also upon other fossils which are occasionally associated with it, some of these dendroid forms may perhaps have grown; but no connexion has yet been clearly seen.

We are not without evidence that the other genera of the Dendroidea were similarly attached to foreign bodies or to the sea-bottom. Even if this were wanting, these dendroid graptolites are so nearly allied to each other (*Callograptus* forming an intermediate link between *Dictyonema* and *Dendrograptus,* to which also *Ptilograptus* is nearly allied) that we might safely have inferred that the mode of existence of all these forms was the same. But the genus *Dendrograptus* has already furnished evidence of the fixedness of these dendroid forms. Professor James Hall, after expressing his belief that the *true* graptolites "in their mature condition were free floating bodies in Silurian seas," thus treats of the mode of existence of the *dendroid* graptolites:—

"In regard to another group, including *Dendrograptus, Callograptus,* and *Dictyonema,* as well as one or two other forms, we have some evidence indicative of a different mode of existence. The stems of *Dendrograptus* are enlarged towards their base, and sometimes present a sudden expansion or bulb, which I have inferred may be the base or root, once attached to another substance, or imbedded in the mud or sand of the sea-bottom." . . . . . . "In those which I have termed *Callograptus*, the bases of the fronds are imperfect, but indicate, according to analogy, a radicle or point of attachment like *Dendrograptus*. In the more nearly entire forms of *Dictyonema* known, we have not been able to observe the base; but, from their similarity in form and mode of growth to *Fenestella* and *Retepora*, we have inferred their attachment either to the sea-bottom or to foreign bodies." (20th Rep. New-York State Cab. Nat. Hist., p. 238, ed. 1870.)

The bearing of this on the question of the systematic position of the Dendroidea alone remains for consideration. It has already been shown that the Rhabdophora differ from our recent Sertularian Hydroida only in their possession of a slender rod or virgula, and in their having apparently been free. The Dendroidea offer no such points of difference, being essentially similar to the recent Sertularian zoophytes in their mode of growth, as well as in their general form, and, as far as their imperfect state of preservation enables us to determine, in their intimate structure also. On this last and most important point, however, we have no certain knowledge: while we know of no characters whereby the Dendroidea can be separated from the Hydrozoa, we are equally destitute of decisive evidence of their structural difference from the Polyzoa; nor can we wonder at this when we consider how long these two classes were grouped together under the general term of Zoophyte or Coralline.

Dictyonema certainly seems more Polyzoan than Hydrozoan in its affinities, while *Ptilograptus*, on the other hand, seems to be far more nearly related to the Hydrozoa than to the Polyzoa; and analogy with the true graptolites, which are certainly Hydroids, would lead us to infer that the Dendroidea have the same internal structure as they have. If this should prove to be the case, the genera *Ptilograptus* and *Dendrograptus* would fall naturally into families already existing in the sub-order Thecaphora (or Sertularina), while for *Callograptus* and *Dictyonema*, which have their branches more or less regularly connected together by transverse processes, a new family would have to be instituted. At present we do not know of any tangible character whereby the Dendroidea, considered as a single group, can be separated as a distinct sub-order from the Thecaphora. In the mean time the term *Graptolite* may still be used as a general term for all the forms to which the name has been applied, as the term *Zoophyte* was formerly used for such different beings as the Hydrozoa, the Actinozoa, and the Polyzoa.

EXPLANATION OF PLATE X.

Callograptus radicans, Hopk., natural size. Photo-lithographed from a specimen collected by the author in the Arenig rocks, Ramsey Island, St. David's, South Wales.

XXXVI.—*The Mollusca of Europe compared with those of Eastern North America.* By J. GWYN JEFFREYS, F.R.S.[*]

AFTER mentioning that he had dredged last autumn on the coast of New England in a steamer provided by the Government of the United States, and that he had inspected all the principal collections of Mollusca made in Eastern North America, the author compared the Mollusca of Europe with those of Massachusetts. He estimated the former to contain about 1000 species (viz. 200 land and freshwater, and 800 marine), and the latter to contain about 400 species (viz. 110 land and freshwater, and 290 marine); and he took Mr. Binney's edition of the late Professor Gould's 'Report on the Invertebrata of Massachusetts,' published in 1870, as the standard of comparison. That work gives 401 species, of which Mr. Jeffreys considered 41 to be varieties and the young of other species, leaving 360 apparently distinct species. About 40 species may be added to this number in consequence of the recent researches of Professor Verrill and Mr. Whiteaves on the coast of New England and in the Gulf of St. Lawrence. Mr. Jeffreys identified 173 out of the 360 Massachusetts species as European, viz. land and freshwater 39 (out of 110), and marine 134 (out of 250), the proportion in the former case being 28 per cent., and in the latter nearly 54 per cent.; and he produced a tabulated list of the species in support of his statement. He proposed to account for the distribution of the North-American Mollusca thus identified, by showing that the land and freshwater species had probably migrated from Europe to Canada through Northern Asia, and that most of the marine species must have been transported from the Arctic seas by Davis's-Strait current southwards to Cape Cod, and the remainder from the Mediterranean and western coasts of the Atlantic by the Gulf-stream in a northerly direction. He renewed his objection to the term "representative species."

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[*] An abstract of a communication made by the author to the Brighton Meeting of the British Association, and now published at his request.

The author concluded by expressing his gratitude for the kind hospitality and attention which he received from naturalists during his visit to North America last year.

Mollusca of Eastern North America, according to Binney's edition of Gould's 'Invertebrata of Massachusetts.'

Page.	Name of Species.	North or South of Cape Cod.	European.	Synonyms and Remarks.
28	Teredo navalis, *Linné*	N	E	Wood's Hole, Mass. (J. G. J.).
29	—— Norvagica, *Spengler*	N	E	
30	—— megotara, *Hanley*	N	E	
31	—— Thompsonii, *Tryon*	S		
32	—— dilatata, *Stimpson*	N	......	*T. megotara*, variety.
33	—— chlorotica, *Gould* (1870).	N	E	*T. pedicellata*, Quatrefages (1849), var.
34	Xylotrya fimbriata, *Jeffreys*	S		
36	Pholas costata, *L.*	S		
38	—— truncata, *Say*	S		
39	Zirfæa crispata, *L.*	N	E	Genus *Pholas*.
40	Solen ensis, *L.*	N	E	
43	Solecurtus gibbus, *Sp.*	S		
44	—— divisus, *Sp.*	S		
46	Machæra squama, *Blainville*	N	......	G. *Siliqua*.
47	—— costata, *Say*	N		G. *Siliqua*.
48	Solemya velum, *Say* (1822)	N	......	*S. togata*, young.
50	—— borealis, *Totten* (1834)	N	E	*S. togata*, Poli (1791).
51	Panopæa arctica, *Lamarck* (1818)	N	E	*Saxicava Norvegica*, sp. (1793).
53	Glycymeris siliqua, *Chemnitz*	N	E	G. *Cyrtodaria*.
55	Mya arenaria, *L.*	N	E	
58	—— truncata, *L.*	N	E	
60	Corbula contracta, *Say*	S		
61	Neæra pellucida, *St.*	N	E	
62	Pandora trilineata, *Say*	N		
64	Lyonsia hyalina, *Conrad*	N	......	Allied to *L. Norvegica*.
65	—— arenosa, *Möller*	N	E	
66	Anatina papyracea, *Say*	N		
68	Cochlodesma Leanum, *Conr.*	N	......	Allied to *Thracia prætenuis*, which is European.
69	Thracia Conradi, *Couthouy* (1838)	N	......	*T. inflata*, J. Sowerby (1845).
71	—— myopsis (*Beck*), *Möll.* (1842)	N	E	*T. truncata*, Brown (1827).
72	—— truncata, *Mighels & Adams* (1842)	N	E	Not *T. truncata*, Br. *T. septentrionalis*, Jeffr. MS.
73	Mactra solidissima, *Ch.*	N	......	Lovén received a single valve from Finmark.
75	—— ovalis, *Gould*	N	......	*M. solidissima*, var.
77	—— lateralis, *Say*	N	......	Allied to *M. subtruncata*, which is European.
79	Cumingia tellinoides, *Conr.*	S		
80	Ceronia arctata, *Conr.*	N	......	*Mesodesma deauratum*, var.
81	—— deaurata, *Turton*	N	......	G. *Mesodesma*.

Page.	Name of Species.	North or South of Cape Cod.	European.	Synonyms and Remarks.
83	Kellia planulata, *St.*	N	......	G. *Lasæa.*
83	—— suborbicularis, *Montagu.*	N	E	
85	Turtonia minuta, *Fabricius*	N	E	G. *Cyamium.*
86	Montacuta elevata, *St.*	N	E	
87	Saxicava rugosa, *Pennant*	N	E	Linné instead of Pennant.
89	—— arctica, *L.*	N	......	*S. rugosa*, var.
90	Petricola pholadiformis, *Lam.*	N	......	Valentia, Ireland; a fragment.
92	—— dactylus, *Say*	N	......	*P. pholadiformis*, var.
93	Macoma fusca, *Say* (1826)	N	E	*Tellina Balthica*, L. (1766).
95	—— proxima, *Gray* (1839)	N	E	*T. calcaria*, Ch. (1782).
96	Tellina tenta, *Say*	S		
97	—— tenera, *Say*	N	......	Allied to *T. tenuis.*
98	Lucina filosa, *St.* (1851)	N	E	*L. borealis*, L. (1766).
99	—— dentata, *Wood*	S		
100	Cryptodon Gouldii, *Philippi* (1845)	N	E	*Axinus flexuosus*, Mont., var. (1803).
101	Sphærium simile, *Say* (1816).	N	......	*S. striatinum*, Lam. (1818).
103	—— partumeium, *Say* (1822)	N	E	*S. lacustre*, Müller (1774).
104	—— rhomboideum, *Say*	N	......	Allied to *S. corneum*, which is European.
105	—— Vermontanum, *Prime* (1861)	N	E	*S. pisidioides*, Gray (1856). Perhaps introduced into England.
106	—— truncatum, *Linsley*	N	......	*S. lacustre*, var.
107	—— tenue, *Prime*	N		
107	—— securis, *Prime*	N	......	*S. lacustre*, var. *Rykholtii.*
108	—— occidentale, *Prime*	N		
109	Pisidium dubium, *Say* (1816)	N	E	*P. amnicum*, Müll. (1774).
110	—— Adamsii, *Prime* (1851)	N	E	*P. fontinale*, Draparnaud (1805).
110	—— compressum, *Prime*	N		
112	—— æquilaterale, *Prime*	N	......	Allied to *P. nitidum*, which is European.
113	—— ferrugineum, *Prime*	N	......	*P. pusillum*, var. *obtusalis.*
113	—— abditum, *Haldeman* (1841)	N	E	*P. pusillum*, Gmelin (1788).
115	—— variabile, *Prime*	N		
116	—— ventricosum, *Prime*	N	......	Possibly some of these North-American species may be reduced in number.
117	Astarte castanea, *Say*	N	......	Perhaps a variety of *A. borealis*, Ch.
119	—— sulcata, *Da Costa*	N	E	Including *A. undata*, Gould = *A. Omalii*, J. Sow.
121	—— semisulcata, *Leach* (1817)	N	E	*A. borealis*, Ch. (1784), var.
123	—— quadrans, *Gould*	N	......	*A. castanea*, var. *nana.*
124	—— elliptica, *Hanley*	N	......	*A. sulcata*, var.
125	—— Banksii, *Leach* (1817)	N	E	*A. compressa*, Mont. (1803), var.
126	—— crebricostata, *Forbes* (1847)	N	E	*A. depressa*, Br. (1827).

Page.	Name of Species.	North or South of Cape Cod.	European.	Synonyms and Remarks.
127	Astarte Portlandica, *Mighels*	N	......	*A. compressa*, var.
128	Gouldia mactracea, *Linsley*	N	......	G. *Crassatella*.
129	Cyprina Islandica, *L.*	N	E	
131	Cytherea convexa, *Say*	N	......	G. *Venus*.
133	Venus mercenaria, *L.*	N		
135	—— notata, *Say*	N	......	*V. mercenaria*, var.
136	Tapes fluctuosa, *Gould*	N	E	G. *Venus*.
137	Gemma gemma, *Totten*	N	......	*V. mercenaria*, young.
138	—— Manhattensis, *Prime*	S		
139	Cardium Islandicum, *L.*	N	E	
141	—— elegantulum (*Beck*), *Möll.*	N	E	
143	Liocardium Mortoni, *Conr.*	N	......	G. *Cardium*.
144	Aphrodita Grœnlandica, *Ch.*	N	E	
146	Cardita borealis, *Conr.* (1836)	N	E	*C. sulcata*, Bruguière (1792), var.
147	Arca pexata, *Say*	S		
148	—— transversa, *Say*	N	......	*A. pexata*, var.
149	Nucula tenuis, *Mont.*	N	E	
150	—— proxima, *Say*	N		
152	—— expansa, *Reeve*	N	......	*N. tenuis*, var.
153	—— delphinodonta, *Migh.*	N	E	
154	Yoldia limatula, *Say* (1831)	N	E	*Y. arctica*, Sars. G. *Leda*.
155	—— obesa, *St.*	N	......	Allied to *Leda lucida*, which is European.
156	—— siliqua, *Reeve* (1855)	N	E	*L. arctica*, Gray (1819).
157	—— thraciæformis, *Storer*	N	E	G. *Leda*.
159	—— sapotilla. *Gould* (1841)	N	E	*L. hyperborea*, Lov. (1846).
160	—— myalis, *Couth.*	N	......	G. *Leda*.
161	Leda tenuisulcata, *Couth.* (1838)	N	E	*L. pernula*, Müll. (1770), var.
163	—— Jacksonii, *Gould*	N	......	*L. pernula*, var.
164	—— minuta, *Fabr.*	N	E	Müll. instead of Fabr.
165	—— caudata, *Donovan*	N	......	*L. minuta*, var.
167	Unio complanatus, *Solander*	N		
169	—— nasutus, *Say*	N		
170	—— radiatus, *Gm.*	S		
172	—— cariosus, *Say*	S		
173	—— ochraceus, *Say*	S	......	Perhaps *U. cariosus*, var.
174	Margaritana arcuata, *Barnes* (1823)	N	E	*Unio margaritifer*, L. (1766).
176	—— undulata, *Say*	S	......	G. *Unio*.
177	—— marginata, *Gould*	S	......	G. *Unio*.
178	Anodon fluviatilis, *Lea*	S	......	Dillwyn (1817) instead of Lea. *Anodonta cygnea*, L. (1766).
180	—— implicata, *Say*	N	......	G. *Anodonta*. *A. cygnea*, var.
182	—— undulata, *Say*	S	......	G. *Anodonta*.
183	Mytilus edulis, *L.*	N	E	
186	Modiola modiolus, *L.*	N	E	G. *Mytilus*.
188	—— plicatula, *Lam.*	N	......	G. *Mytilus*.
190	Modiolaria nigra, *Gray*	N	E	
192	—— discors, *L.*	N	E	

Page.	Name of Species.	North or South of Cape Cod.	European.	Synonyms and Remarks.
193	Modiolaria corrugata, *St*.......	N	E	
194	Crenella glandula, *Tott.*	N		
195	—— pectinula, *Gould* (1841).	N	E	*C. faba*, Fabr. (1780).
196	Pecten tenuicostatus, *Migh. & Ad.*	N		
198	—— Islandicus, *Müll.*.........	N	E	
199	—— irradians, *Lam.*	N		
200	—— fuscus, *Linsl.*	N	......	*P. irradians*, young.
202	Ostrea Virginiana, *Lister*......	N		
203	—— borealis, *Lam.*	S	......	*O. Virginiana*, var.
204	Anomia ephippium, *L*.........	N	E	
204	—— aculeata, *Gm.*	N	......	*A. ephippium*, var.
205	—— electrica, *L*...............	N	......	*A. ephippium*, var.
206	—— squamula, *L*...............	N	......	*A. ephippium*, young.
208	Terebratulina septentrionalis, *Couth.* (1839)	N	E	*Terebratula caput-serpentis*, L. (1764), var.
210	Rhynchonella psittacea, *Gm.* .	N	E	
211	Waldheimia cranium, *Gm.* ...	N	E	Müll., instead of Gm. G. *Terebratula.*
213	Philine sinuata, *St.*	N	......	Allied to *P. nitida*, which is European.
213	—— quadrata, *S. Wood.*	N	E	
214	—— lineolata, *Couth.* (1839) .	N	E	*P. lima*, Br. (1827).
215	Scaphander puncto-striatus, *Migh. & Ad.* (1842)	N	E	*S. librarius*, Lov. (1846).
216	Diaphana hiemalis, *Couth.* (1839)...........................	N	E	*Utriculus globosus*, Lov.(1846).
216	—— debilis, *Gould* (1840) ...	N	E	*Utriculus hyalinus*, Turt. (1834).
217	Utriculus Gouldii, *Couth.* (1839)............................	N	E	*U. turritus*, Möll. (1842).
218	—— pertenuis, *Migh.*	N	......	*U. Gouldii*, young.
219	—— canaliculatus, *Say*	S		
220	Cylichna alba, *Br*...............	N	E	
221	—— oryza, *Tott.* (1835)	N	E	*Bulla utriculus*, Brocchi (1814).
222	Bulla incincta, *Migh.*	N		
222	—— solitaria, *Say*	S		
223	—— occulta, *Migh. & Ad.* (1842)............................	N	E	*Cylichna striata*, Br. (1827).
224	Tornatella puncto-striata, *Ad.*	S	......	Perhaps *Actæon pusillus.* G. *Actæon.*
226	Polycera Lessonii, *D'Orbigny.*	N	E	
228	Doris bilamellata, *L.*	N	E	
229	—— tenella, *Agassiz*	N	......	Perhaps *D. inconspicua*, which is European.
229	—— pallida, *Ag.* (1870)	N	E	*D. aspera*, Alder & Hancock (1842).
230	—— diademata, *Ag.* (1870)...	N	E	*D. tuberculata*, Cuvier (1802).
231	—— planulata, *St.* (1853) ...	N	E	*D. repanda*, A. & H. (1842).
232	—— grisea, *St.*..................	N	......	"Very closely allied to *D. inconspicua.*"

Page.	Name of Species.	North or South of Cape Cod.	European.	Synonyms and Remarks.
233	Ancula sulphurea, *St.*	N	......	"Very like to *Ancula cristata*," which is European.
234	Dendronotus arborescens, *Müll.*	N	E	
236	Doto coronata, *Gm.*	N	E	
238	Æolis papillosa, *L.*	N	E	
240	—— salmonacea, *De Kay* (1843)	N	......	*Eolis bodoensis*, Möll. (1842).
241	—— Bostoniensis, *Couth.*	N	......	"Approaching closely *E. coronata* of Forbes," which is European.
242	—— rufibranchialis, *Johnston.*	N	E	
243	—— pilata, *Gould*	N		
245	—— stellata, *St.*	N		
246	—— purpurea, *St.*	N		
246	—— picta, *A. & H.*	N	E	
247	—— diversa, *Couth.*	N		
248	—— despecta, *Johnst.*	N	E	
249	—— gymnota, *De Kay*	N	......	"Nearly allied to *E. concinna*," which is European.
250	Calliopæa (?) fuscata, *Gould*	N		
251	Embletonia fuscata, *Gould*	N		
252	—— remigata. *Gould*	N		
253	Hermæa cruciata, *Alex. Ag.*	S		
254	Alderia Harvardiensis, *Ag*	N		
255	Elysia chlorotica, *Ag.*	N		
256	Placobranchus catulus, *Ag.*	N		
258	Limapontia zonata, *St.*	N		
258	Chiton apiculatus, *Say*	S		
259	—— cinereus, *L.*	S	E	*C. marginatus*, not *C. cinereus.* A single specimen only; questionable.
260	—— ruber, *Lowe*	N	E	
261	—— marmoreus, *Fabr.*	N	E	
263	—— albus, *Mont.*	N	E	L., not Mont.
263	—— mendicarius, *Migh. & Ad.* (1842)	N	E	*C. Hanleyi* (Bean), Thorpe (1844).
264	Amicula Emersonii, *Couth.*	N		
266	Dentalium dentale, *L.*	N	......	*D. striolatum*, var.
266	Entalis striolata, *St.* (1851)	N	E	*Dentalium abyssorum*, Sars (1858), var.
267	Tectura testudinalis, *Müll.*	N	E	
269	—— alveus, *Conr.*	N	......	*T. testudinalis*, var.
270	Lepeta cæca, *Müll.*	N	E	
271	Crepidula fornicata, *L.*	N	E	
272	—— plana, *Say*	N	......	*C. fornicata*, var.
273	—— convexa, *Say*	N		
274	—— glauca, *Say*	N	......	*C. fornicata*, var.
275	Crucibulum striatum, *Say*	N		
276	Cemoria noachina, *L.*	N	E	G. *Puncturella.*
277	Ianthina fragilis, *Deshayes*	N	E	Lam., not Desh. Specific name changed to *communis* (1822).

Page.	Name of Species.	North or South of Cape Cod.	European.	Synonyms and Remarks.
278	Adeorbis costulata, *Möll.*	N	E	G. *Mölleria.*
279	Margarita cinerea, *Couth.*	N	E	G. *Trochus.*
280	—— undulata, *Sowerby* (1838)	N	E	*Trochus Grænlandicus*, Ch. (1781).
281	—— helicina, *Fabr.*	N	E	G. *Trochus.*
282	—— argentata, *Gould* (1841).	N	E	*Trochus glaucus*, Möll. (1842).
283	—— obscura, *Couth.*	N	E	G. *Trochus.*
284	—— acuminata, *Migh. & Ad.*	N	......	*Trochus varicosus*, young.
285	—— varicosa, *Migh. & Ad.* (1842)	N	E	*M. elegantissima* (Bean), S. Wood (1848). G. *Trochus.*
286	Trochus occidentalis, *Migh. & Ad.*	N	E	
286	Valvata tricarinata, *Say* (1817)	N	E	*V. piscinalis*, Müll. (1774), var.
288	—— pupoidea, *Gould*	N		
289	Melantho decisa, *Say*	N		
292	Amnicola pallida, *Haldeman*	N	......	G. *Hydrobia.*
293	—— limosa, *Say*	N	......	G. *Hydrobia.*
294	—— granum, *Say*	S	......	G. *Hydrobia.*
295	Pomatiopsis lapidaria, *Say*	S		
296	Skenea planorbis, *Fabr.*	N	E	
297	Rissoella ? eburnea, *St.*	N	......	G. *Rissoa.*
297	—— sulcosa, *Migh.*	N	......	G. *Rissoa.* One specimen only.
298	Rissoa minuta, *Tott.* (1834)	N	E	*Hydrobia ventrosa*, Mont. (1803), var.
299	—— latior, *Migh. & Ad.*	N		
299	—— aculeus, *Gould* (1841)	N	E	*R. striata*, J. Adams (1795).
300	—— multilineata, *St.*	N	......	*R. striata*, var.
301	—— Mighelsi, *St.*	N		
301	—— exarata, *St.*	N		
301	—— carinata, *Migh. & Ad.*	N		
302	Lacuna vincta, *Mont.* (1803)	N	E	*L. divaricata*, Fabr. (1780).
303	—— neritoidea, *Gould* (1840)	N	E	*L. pallidula*, Turt. (1827), var.
304	Littorina rudis, *Don.*	N	E	Maton, instead of Don.
306	—— tenebrosa, *Mont.*	N	E	*L. rudis*, var.
308	—— litorea, *L.*	N	E	
309	—— palliata, *Say* (1822)	N	E	*L. obtusata*, L. (1766), var. = *L. limata*, Low. (1846).
311	—— irrorata, *Say*	S		
311	Scalaria Nov-angliæ, *Couth.*	N	......	*S. multistriata*, var.
312	—— lineata, *Say*	S		
313	—— multistriata, *Say*	S		
314	—— Grœnlandica, *Ch.*	N	E	
315	Cæcum pulchellum, *St.*	S		
316	Vermetus radicula, *St.*	S		
317	Turritella erosa, *Couth.* (1839)	N	E	*T. polaris*, Möll. (1842).
318	—— reticulata, *Migh. & Ad.* (1842)	N	E	*T. lactea*, Möll. (1842).
319	—— acicula, *St.*	N		
320	Aporrhais occidentalis, *Beck.*	N		
321	Bittium nigrum, *Tott.*	S	......	G. *Cerithium.*

Page.	Name of Species.	North or South of Cape Cod.	European.	Synonyms and Remarks.
322	Bittium Greenii, *Ad.* (1839)	N	E	*Cerithiopsis tubercularis*, Mont. (1803).
323	Triforis nigrocinctus, *Ad.*	S		
325	Odostomia producta, *Ad.*	S		
325	—— fusca, *Ad.*	S		
327	—— dealbata, *St.*	N		
327	—— modesta, *St.*	N		
327	—— bisuturalis, *Say*	N		
328	—— trifida, *Tott.*	S	......	*O. impressa*, var.
329	—— seminuda, *Ad.*	N		
330	—— impressa, *Say* (1822)	S	......	*O. cælata*, Cailliaud (1865).
331	Turbonilla interrupta, *Tott.* (1834)	N	E	*Melania rufa*, Ph. (1836), var. G. *Odostomia*.
331	—— nivea, *St.*	N	......	Perhaps *Turbo lacteus*, L. G. [*Odostomia*.
332	Eulima oleacea, *Kurtz & St.*	S		
333	Menestho albula, *Moll.*	N	......	Apparently not this species, which is European.
334	Velutina haliotoidea, *Fabr.* (1780)	N	E	*V. lævigata*, Pennant (1777).
335	—— zonata, *Gould* (1841)	N	E	*V. undata*, Brown (1827).
337	Lamellaria perspicua, *L.*	N	E	
338	Lunatia heros, *Say* (1822)	N	......	*Natica catenoides*, S. Wood (1848).
340	—— triseriata, *Say*	N	......	*Natica heros*, young.
341	—— Grœnlandica, *Moll.*	N	E	Beck, *fide* Möll. G. *Natica*.
342	Natica clausa, *Broderip & Sow.* (1829)	N	E	*N. affinis*, Gm. (1790).
344	—— pusilla, *Say*	S		
344	Mamma? immaculata, *Tott.*	N	......	G. *Natica*.
345	Neverita duplicata, *Say*	S	......	G. *Natica*.
347	Bulbus flavus, *Gould* (1840)	N	E	*Natica Smithii*, Brown (1839) =*N. aperta*, Lov. (1846).
348	Amauropsis helicoides, *Johnst.* (1835)	N	E	*Natica Islandica*, Gm. (1790).
349	Pleurotoma bicarinata, *Couth.*	N	E	
350	—— plicata, *Ad.* (1842)	N	E	*P. declivis*, Lov. (1846).
351	Bela turricula, *Mont.*	N	E	G. *Pleurotoma*.
352	—— harpularia, *Couth.*	N	E	G. *Pleurotoma*.
353	—— violacea, *Migh. & Ad.* (1842)	N	E	*Defrancia Beckii*, Möll. (1842). G. *Pleurotoma*.
354	—— decussata, *Couth.* (1841).	N	E	*Pleurotoma Trevelyana*, Turt. (1834).
355	—— cancellata, *Migh. & Ad.* (1842)	N	E	*Defrancia Pingelii*, Möll. (1842). G. *Pleurotoma*.
355	—— pleurotomaria, *Couth.* (1839)	N	E	*Buccinum pyramidale*, Ström (179—). G. *Pleurotoma*.
356	Columbella avara, *Say*	S		
357	—— rosacea, *Gould* (1840)	N	E	*C. Holböllii* (Beck), Möll. (1842).

Page.	Name of Species.	North or South of Cape Cod.	European.	Synonyms and Remarks.
358	Columbella dissimilis, *St.*	N		
359	—— lunata, *Say*	S		
360	Purpura lapillus	N	E	
362	Nassa obsoleta, *Say*	N	……	Subgenus *Desmoulea.*
364	—— trivittata, *Say* (1822)	N	……	*N. propinqua*, J. Sow. (1824).
365	—— vibex, *Say*	S		
366	Buccinum undatum, *L.*	N	E	
368	—— ciliatum, *Fabr*	N	E	Not that species, but *B. undulatum*, Möll.
369	—— Donovani, *Gray* (1839)	N	E	*B. glaciale*, L (1766).
370	—— cinereum, *Say*	N	……	G. *Urosalpinx*, allied to *Purpura.*
371	Fusus Islandicus, *Gm.*	N	……	Not that species, but *F. curtus*, Jeffr.
372	—— pygmæus, *St.*	N	……	Not *Buccinum Sabinii* or *Fusus Sabini*, Gray.
373	—— ventricosus, *Gray*	N		
374	—— tornatus, *Gould* (1840)	N	E	*F. despectus*, L. (1766).
375	—— decemcostatus, *Say*	N		
377	Trophon clathratus, *L.*	N	E	Not that species, but *T. truncatus*, Str.
378	—— scalariformis, *Gould* (1840)	N	E	*T. clathratus*, L. (1766).
379	—— muricatus, *Mont.*	N	E	Doubtful as American.
380	Busycon canaliculatum, *L.*	S		
383	—— carica, *Gm.*	S		
385	Fasciolaria ligata, *Migh. & Ad.*	N		
386	Ranella caudata, *Say*	S		
387	Cerithiopsis Emersonii, *Ad.*	S	……	G. *Cerithium*, not *Cerithiopsis.*
389	—— terebralis, *Ad.* (1841)	S	E	*C. trilineata*, Ph. (1836).
390	Trichotropis borealis, *Sow.*	N	E	Broderip and Sowerby's species.
391	Admete viridula, *Fabr.*	N	E	
394	Vitrina limpida, *Gould* (1850)	N	E	*V. pellucida*, Müll. (1774).
395	Hyalina cellaria, *Müll.*	N	E	G. *Zonites.*
396	—— arborea, *Say*	N	……	Closely allied to *Z. excavatus*, but umbilicus much less open.
397	—— electrina, *Gould* (1841)	N	E	*Zonites radiatulus*, Alder (1830), var. *alba.*
398	—— indentata, *Say*	N		
399	—— minuscula, *Binney*	N		
400	—— Binneyana, *Morse*	S		
401	—— milium, *Morse*	N		
401	—— ferrea, *Morse*	N		
402	—— chersina, *Say* (1821)	N	E	*Zonites fulvus*, Müll. (1774).
403	—— minutissima, *Lea* (1841)	N	E	*Helix pygmæa*, Drap. (1805).
404	—— multidentata, *Binney*	N		
404	—— lineata, *Say*	N		
406	Macrocyclis concava, *Say*	N		
407	Limax maximus, *L.*	N	E	
408	—— agrestis, *L.*	N	E	
409	—— campestris, *Binney* (1841)	N	E	*L. lævis*, Müll. (1774).

Page.	Name of Species.	North or South of Cape Cod.	European.	Synonyms and Remarks.
410	Limax flavus, *L.*	N	E	
412	Helix alternata, *Say*	N		
413	—— striatella, *Anthony*	N		
415	—— asteriscus, *Morse*	N		
415	—— labyrinthica, *Say*	N		
417	—— hirsuta, *Say*	N		
418	—— monodon, *Rackett*	N		
420	—— palliata, *Say*	N		
422	—— tridentata, *Say*	N		
423	—— albolabris, *Say*	N		
424	—— dentifera, *Binn.*	N		
425	—— thyroides, *Say*	N		
426	—— Sayii, *Binn.*	N		
427	—— ? harpa, *Say*	N	E	Sweden.
428	—— pulchella, *Müll.*	N	E	
429	—— hortensis, *Müll.* (1774)	N	E	*H. nemoralis*, L. (1766), var.
431	Cionella subcylindrica, *L.*	N	E	Perhaps that species, but described as inhabiting fresh water. *Cochlicopa lubrica*, Müll.
433	Pupa muscorum, *L.*	N	E	Linné's species is unascertainable. *P. marginata*, Drap.
433	—— Hoppii, *Möll.*	N		
434	—— pentodon, *Say*	N		
435	—— decora, *Gould*	N		
436	—— fallax, *Say*	S		
437	—— armifera, *Sag*	N		
438	—— contracta, *Say*	N		
439	—— rupicola, *Say*	N		
439	—— corticaria, *Say*	N		
440	Vertigo Gouldii, *Binn.* (1843)	N	E	*V. alpestris*, Ald. (1830).
441	—— milium, *Gould*	N		
442	—— Bolleziana, *Morse* (1865)	N	E	*V. pygmæa*, Drap. (1801).
442	—— ovata, *Say* (1822)	N	E	*V. antivertigo*, Drap. (1801).
443	—— ventricosa, *Morse* (1865).	N	E	*V. Moulinsiana*, Dupuy (1843).
444	—— simplex, *Gould* (1840)	N	E	*V. edentula*, Drap. (1805).
445	Succinea ovalis, *Gould* (1841).	N	E	*S. elegans*, Risso (1826).
446	—— avara, *Say*	N	......	Allied to *S. putris*, var. *ochracea.*
447	—— obliqua, *Say* (1824)	N	E	*S. putris*, L. (1766).
448	—— Totteniana, *Lea*	N	......	*S. putris*, var.
451	Arion fuscus, *Müll.* (1774)	N	E	Perhaps that species. *A. hortensis*, Férussac (1819).
453	Zonites inornata, *Say*	N	......	*Zonites* is masculine; see De Montfort.
454	—— suppressa, *Say*	N		
454	—— fuliginosa, *Griffith*	N		
457	Tebennophorus dorsalis, *Binn.*	N		
465	Alexia myosotis, *Drap.*	N	E	G. *Melampus.*
466	Carychium exiguum, *Say* (1822)	N	E	*C. minimum*, Müll. (1774).

Page.	Name of Species.	North or south of Cape Cod.	European.	Synonyms and Remarks.
467	Melampus bidentatus, *Say*	N	......	Specific name preoccupied. *M. corneus*, Desh.
471	Limnæa columella, *Say* (1817)	N	E	*L. peregra*, Müll. (1774).
473	—— decollata, *Migh.*	N	......	*L. catascopium*, var.
474	—— ampla, *Migh.*	N		
475	—— elodes, *Say* (1821)	N	E	*L. palustris*, Müll. (1774).
478	—— desidiosa, *Say*	N	......	*L. truncatula*, var.
479	—— catascopium, *Say*	S		
480	—— umbilicata, *Ad.*	N	......	Allied to *L. truncatula.*
481	—— pallida, *Ad.*	N	......	*L. truncatula*, var. *elegans.*
482	—— humilis, *Say* (1822)	N	E	*L. truncatula*, Müll. (1774).
483	Physa heterostropha, *Say*	N	......	More nearly allied to *P. rivalis*, Mat. & Rack. than to *P. fontinalis.*
485	—— ancillaria, *Say*	S		
486	Bulinus elongatus, *Say* (1821)	N	E	*Physa hypnorum*, L. (1766).
488	Planorbis trivolvis, *Say*	N		
490	—— lentus, *Say*	N	......	*P. trivolvis*, var.
491	—— bicarinatus, *Say*	N		
492	—— campanulatus, *Say*	N		
493	—— hirsutus, *Gould* (1840)	N	E	*P. albus*, Müll. (1774).
494	—— deflectus, *Say*	N	......	*P. albus*, var. *Draparnaldi.*
495	—— exacutus, *Say*	N	......	Allied to *P. nitidus.*
497	—— parvus, *Say* (1817–19)	N	E	*P. glaber*, Jeffr. (1828).
498	—— dilatatus, *Gould*	N	E	Perhaps introduced into England and naturalised.
499	Segmentina armigera, *Say*	N	......	G. *Planorbis.*
501	Ancylus parallelus, *Hald.*	N	......	Allied to *A. lacustris.*
502	—— fuscus, *Ad.*	N		
504	Diacria trispinosa, *Lesueur*	N	E	G. *Cavolina.*
504	Psyche globulosa, *Rang*	N		
505	Heterofusus balea, *Møll.*	N	......	G. *Spirialis.*
505	—— retroversus, *Fleming*	N	E	G. *Spirialis.*
507	Clione limacina, *Phipps* (1773)	N	E	*C. papilionacea*, Pallas (1766).
509	Loligopsis pavo, *Les.*	N		
510	Ommastrephes sagittatus, *Fér. & D'Orb.*	N	......	Lamarck's species. G. *Ommatostrephes.*
513	Loligo punctata, *De Kay*	S		
514	—— Pealei, *Les.*	N		
516	Spirula fragilis, *St.* (1860)	S	......	*S. australis*, Brug. (1789–92).

XXXVII.—*Remarks on the Genera* Trimerella, Dinobolus, *and* Monomerella. By THOMAS DAVIDSON, F.R.S., F.G.S., &c., and WILLIAM KING, Sc.D., Professor of Mineralogy and Geology in Queen's College, Galway.

THE genera named in the title constitute, in our opinion, a new family, belonging to the helictobrachial section of the class *Palliobranchiata* or *Brachiopoda*. We propose to designate it *Trimerellidæ*, after the type genus. Although more or less treated of by other writers, we have been induced, especially by the desire of several intimate friends, who have kindly supplied us with the loan of some valuable series of specimens, and presented us with others, to undertake the further elucidation of a most difficult and enigmatical group of shells; and for this assistance our thanks are especially due to Lindström, Walmstedt, Billings, Hall, Whitfield, Meek, and others. These "Remarks," it is necessary to state, are merely preliminary to a detailed memoir we have been preparing for some time past, and which we hope to have completed for the Geological Society in the early part of next session.

The Trimerellids differ much from all others of their class; though their proximate alliance to certain forms seems to admit of determination. We think there is little doubt of their being not only structurally related to the *Lingulidæ* *, but also genetically connected with this family. The first point is of considerable interest, inasmuch as the Lingulids are the *earliest* Palliobranchs that geologists are acquainted with, occurring in Cambrian rocks; while the Trimerellids do not seem to have been in existence prior to the next systemal group, all the forms belonging to the Lower and Upper Silurians. It would therefore appear that the Trimerellids, adopting the doctrine of genetheonomy (by which we mean evolution of species effected mainly through the operation of Divine laws, and not by purposeless or accidental modifications†), have been produced out of the Lingulids. Moreover, considering that the earliest Palliobranchs, taking them to be represented by the existing aniferous Lingulas, are of a simpler type than the non-aniferous Terebratulids and Rhynchonellids that succeeded them, the conclusion suggests itself that the latter and *simpler* groups are the degraded successors of a type that existed in the earliest known Life-period of our planet. Another matter for consideration is the fact that the Cambrian Lingulids were furnished with a framework of a horny or slightly calcareous nature, as was generally the case with their contemporaneous Cœlenterates and Crustaceans, making it doubtful that ordinary marine calcium compounds were important solutions in the seas of their period; while the fact that the Trimerellids had essentially a calcareous framework, as was the case with a vast number of their coeval organisms, seems to show not only that such compounds had increased in the Silurian seas, but further to support the conclusion that the family we are engaged with is a post-genetheonomic branch of the Lingulids. With the physical changes indicated, the shells of the present family underwent important modifications compared with the group from which they presumedly originated.

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* For the present we include *Obolus* and other related genera in the *Lingulidæ*—though we are strongly inclined to regard the genus named as typical of another family, *Obolidæ*.

† See 'Geologist,' vol. v. p. 254.

The Trimerellids are strongly differentiated by the variety and form of their parts. The species, in general remarkably distinguished by their massive umbonal region, have, speaking subject to correction, the ventral or rostral valve characterized by possessing twenty-four different parts, their dorsal one having sixteen. Many of the parts are so unlike what are seen in other families as to defy all attempts to determine their uses or functions. One consideration that strikes us forcibly is that such parts as the teeth and cardinal process (essentials in other Palliobranchs) are exceedingly mutable, not only in a genus, but in a species: besides, they are rarely well defined. The teeth may be large and crude in certain individuals, but rudimentary or obsolete in others of the same species. The cardinal process may be a thick projecting lamina, or rude in shape and massive, or absent altogether. The deltidium seems to be less liable to modifications: situated on a well-developed area, it is bounded by two rather prominent ridges, one on each side, with their inner and projecting terminations serving as teeth. The usual areal border lies on the outside of each of the deltidial ridges. The deltidium itself is, in general, wide and transversely marked with strong lamina-like lines: it presents the appearance of being excavated out of the areal face (or underlying solid portion) of the beak, agreeing in this respect with what obtains in *Lingula*. In our forthcoming memoir it will be shown that another part, the deltidial slope, further testifies to the close affinity between the Trimerellids and the last-named genus. The hinge or cardinal plate, which requires more explanation than can be given on the present occasion, is so variable in one species (*Trimerella Lindströmi*) as to be with difficulty recognized in some individuals. The hinge-wall, as will shortly be seen, is equally subject to variation. The umbo or beak, which is usually prominent, presents itself under different appearances. Somewhat constant in form, it may, according to the species, be subconical and massive, or compressed into a thin V-shaped plate: in one genus it is obtusely rounded. In the first of these conditions it may be solid or double-chambered: the chambers are separated by either a thick or a thin partition; and they are shallow and wide-mouthed, or long and tubular. We are not acquainted with any thing strictly resembling the partition in other Palliobranchs. In *Pentamerus*, it is true, the umbonal cavity is divided by a medio-longitudinal plate, giving rise to two lateral chambers: in this last genus, however, the dividing plate is double, causing it, when a specimen is suitably struck with the hammer, to split lengthwise into two halves; but no such division has occurred to us in any specimens of Trimerellids. The undivided condition of the partition seems to be explained on the view that this part is a modified form of the hinge-wall. Passing to the parts seen in the general or valvular cavity of the Trimerellids, the principal are the great muscle-bearing platforms, of which an example occurs in each valve. A similar homologous duplication characterizes other families—Pentamerids, Leptænids, &c.; but the myophores generally occur under a widely different shape. In the typical genus of the present family the platforms are elevated and doubly vaulted, the vaults being tubular and separated by a partition. The latter part is continued beyond or in advance of each platform, where it becomes the ordinary medio-longitudinal septum. A tendency to double-vaulting may be observed in the myophores of some other Palliobranchs, particularly *Leptæna Dutertrii*; in which the ventral one curves over and rests upon the medio-longitudinal septum, forming thereby a doubly vaulted arch. But the nearest approach to this peculiarity, as pointed out by Billings, is undoubtedly presented by the genus *Obolus*, in which certain muscle-bearing scars, usually excavated, have an overlapping posterior margin: in *Crania* something similar is seen. The platforms, with their tubular vaults and biconvex surface, remind one of a double-barrelled pistol. With a pair of this kind associated, as is often the case, with a couple of tubular umbonal chambers, the interior of *Trimerella* presents a singular appearance. In *Monomerella* both platforms are solid and slightly raised; and consequently the absence of vaults gives the interior of this genus a totally different aspect: the umbonal cavity, however, contains two large chambers. *Dinobolus* has neither a vaulted platform, nor a chambered umbo. Each of these three genera contains species in which the myophores vary considerably, being reduced to so rudimentary a condition that it is difficult to allocate the species generically. Hall has been induced to raise an aberrant species of the kind to the rank of a genus, *Rhynobolus*; but this step appears to us to be attended with considerable disadvantage, as it would necessitate instituting a genus for every aberrant form. The scars are numerous and exceedingly complicated by the modifications of the different parts, as just pointed out. After some consideration we have abandoned the attempt to homologize them, except in a few cases. We think the posterior crescent, with its loop and lanceolate scars, corresponds to the post-aponeural impressions in *Lingula* and *Discina*. We are unable to specify which scars have been produced by the valvular muscles, except some situated on the platforms: and with respect to the latter, our efforts to identify them with the valvulars of *Lingula* (the nearest living representative, as we believe) have not, it is to be apprehended, been attended with much success. We have, for the reasons stated, refrained as far as possible from employing terms for the different scars implying their uses, and have, instead, simply given them names denoting their relative position, distinguishing the group in the dorsal valve from that of the ventral one by a different type. Certain scars, or other parts, apparently occupying the same relative positions in the two valves, and which appear to be analogous, bear the same letter, but in a different type: nothing more is meant by this mode of lettering.

The geographical distribution of the Trimerellids is a matter of some importance. Eminently a Silurian group, one might have expected the well-explored region which the labours of Murchison have made classical would have yielded an abundance of examples; but it is remarkable that only a few specimens of a single genus, *Dinobolus*, and apparently the last of their race, have been met with, in the Wenlock limestones and shales near Dudley, and discovered for the first time in 1852. Identical deposits in Gothland contain the same species; but a greater variety of the family occurs rather abundantly in rocks of the "Aymestry" age of that remarkable locality. Canada and adjacent districts in the United States have yielded the greatest variety of species, all of which, with the exception of *Dinobolus canadensis* and *D. magnifica*, are referable to the Upper Silurians. The two species last named occur in the Black-River limestone, a rock which appears to be equivalent to the Upper Llandeilo, or to the base of the Caradoc of this country. A species of *Monomerella* has also been found in Livonia (Russia) in rocks corresponding in age with those in which the same genus occurs in Gothland.

Our labours on the Trimerellids have enabled us to confirm, for the most part, the conclusions of previous writers as to the number of species, and to determine the existence of some others. The three genera are severally constituted in species as follows:—

Trimerella grandis, *Billings.*
—— acuminata, *Billings.*
—— Lindströmi, *Dall.*
—— Billingsii, *Dall.*
—— ohioensis, *Meek.*
—— Dalli, *Dav. & King.*
—— wisbyensis, *Dav. & King.*
Dinobolus Conradi, *Hall.*
—— canadensis, *Billings.*
Dinobolus galtensis, *Billings.*
—— Davidsoni, *Salter.*
—— transversus, *Salter.*
—— Woodwardi, *Salter.*
—— magnifica, *Billings.*
Monomerella Walmstedti, *Dav. & King.*
—— prisca, *Billings.*
—— orbicularis, *Billings.*

With one or two exceptions, all the species will be fully illustrated in five lithographic plates in our forthcoming memoir; in addition to which there will be two woodcut plates of diagram figures explaining the various parts briefly noticed on the present occasion, and another showing the relationship of *Lingula* to the family.

XXXVIII.—*On two new Species of Birds from the Philippine Islands.* By Arthur Viscount Walden, P.Z.S., F.R.S.

Hyloterpe philippinensis, n. sp.

Feathers of the chin, cheeks, throat, and upper breast silky white, edged more or less with cinereous, a dingy sordid aspect being thus given to these parts; an indistinct obscure zone crossing the breast and bordering the upper breast-plumage, consisting of feathers which are dark ashy at their base, then pure white, tipped with dirty yellow; the remainder of the under plumage with the flanks and under tail-coverts sulphur-yellow, each feather, however, being iron-grey at the base and then white; entire head dark smoke-brown, lighter on the ear-coverts; remainder of upper plumage olive green, rather darker on the outer edges of the quills and on the rectrices; under carpals and axillaries pale lemon-white; tail slightly forked; bill horn-brown.

Longitudo

Rostr. a nar.	Alæ.	Caudæ.	Tarsi.
0·32	3·25	3·12	0·75

From an example obtained in Luzon by Dr. B. Meyer and labelled a "male."

Orthotomus castaneiceps, n. sp.

Entire head, lores, streak under the eyes, and the ear-coverts chestnut; nape and interscapulary region dark ashy, with scarcely a tinge of olive-green; feathers of the middle of back, uropygium, and upper tail-coverts dark ashy at base, with yellowish olive-green tips; quills brown, with bright yellowish-green outer edges; rectrices above paler brown, edged near their insertion and more or less throughout their length with the bright yellowish green of the quills; outer rectrices decidedly darker brown than the middle pair; the middle pair, which is longest, with a faint subterminal bar or drop; the next pair with an obvious dark subterminal drop, which is still more evident in the remaining rectrices; all the rectrices with a narrow albescent terminal fringe; on their under surfaces the green edgings appear brighter than when seen from above; a few of the chin-feathers fulvous; throat and cheeks ashy white; feathers of the breast pale ash, with broad luteous or yellowish-white centres, giving the breast a striped appearance; the remainder of the feathers of the under plumage silky white, ashy at the base; those of the flanks with a faint yellowish tinge; shoulder-edge and under carpals yellowish white; axillaries silky white, tipped with yellowish green; thigh-coverts pale ferruginous; maxilla pale horn-brown; mandible yellowish white; legs like the maxilla, only paler. A large species with a long and stout bill.

Longitudo

Rostr. a nar.	Alæ.	Caudæ.	Tarsi.
0·50	2	2·20	0·85

Obtained in the Philippine island of Guimaras by Dr. B. Meyer during the month of March. The single example procured is labelled a "male."

XXXIX.—*On the Nomenclature of the Foraminifera.* By W. K. Parker, F.R.S., and Prof. T. Rupert Jones, F.R.S., F.G.S.

Part XV. *The Species figured by Ehrenberg.*

[Continued from p. 200.]

XIX. MISCELLANEOUS RECENT FORAMINIFERA.

§1. *Tripoli from San Francisco.* (Monatsber. 1853, p. 216.)

Pl. XXXIII. XIII. fig. 27, *Grammostomum simplex*, seems to be a young *Bolivina dilatata* (?).

§2. *Blown Sand, Libyan Desert.*

Pl. XXXIV. X. A. 6. *Triloculina?* Indeterminable.

§3. *Blown Sand, Baltic, near Wismar, Mecklenburg.*

Pl. XXXIV. X. B. 1. *Rotalia globulosa* = *Planorbulina globulosa.*

§ 4. *Deep-sea mud, Ægean Sea*; 1200 feet (*E. Forbes*, 1842). (Monatsb. Berl. Akad. Wiss. 1854.)

Pl. XXXV. A. XIX. A. 6. *Rotalia globulosa*? = *Planorbulina globulosa* (Ehr.), or *Globigerina*?

With Spicules, Diatoms, Polycystines, and sand[*].

§ 5. *Anchor-mud, Cape Blanco, West Africa.*

Pl. XXXV. A. XIX. B. 3. *Calcarina atlantica* = *Planorbulina*?

With Spicules and Diatoms.

§ 6. *Anchor-mud, Spitzbergen.* (Monatsb. 1841, p. 206; Abhandl. 1841, p. 364.)

Pl. XXV. A. XX. 9. *Uvigerina*? *borealis.* Indeterminable; but it may be four chambers of a *Planorbulina* (*Truncatulina*)?

With Spicules, Diatoms, and sand.

§ 7. *Deep-sea Mud, South Pole*; 1620 feet, S. lat. 62° 42′, W. long. 55°. (Monatsb. 1844, p. 191. Sir James Clark Ross, 'Voyage in the Southern and Antarctic Regions,' vol. i. p. 344, 1847. Ann. Nat. Hist. no. 90, vol. xiv. p. 169.)

Pl. XXXV. A. XXII. 22. *Guttulina*? *divergens* (= "*Grammostomum*, 1844"). Indeterminable; it may perhaps be a *Bulimina.*

With Diatoms, Spicules, Polycystines, and sand.

§ 8. *Sea-life of the Deep Atlantic.* (Monatsb. 1853, p. 782; 1854, pp. 54–75, 236–250.)

Pl. XXXV. B. IV. A. Group of Foraminifera, Spicules, Diatoms, Polycystines, and sand; from 10800 feet depth: magnified 100 diameters.

e, f, m. Globigerina, sp.? *Globigerina bulloides.*

g, h. Planulina, sp.? { *g. Glob. bulloides.*
h. Pulvinulina Menardii. }

i. —— { erosa. porosa. } Small thick-set *Globigerina bulloides.*

k, l. ——, sp.? *Globigerina* (small).

n. Rotalia, sp.? Small *Cristellaria* or *Nonionina*?

o. Textilaria, sp.? Small stout *Text. gibbosa.*

p. Grammostomum aculeatum. *Vulvulina aculeata* (Ehr.).

With Spicules, Polycystines, Diatoms, and sand.

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[*] In the 'Monatsberichte' for 1858 (1859, pp. 10–30) Dr. Ehrenberg has given short descriptions of eight "new genera" and seventy-one "new species" of Foraminifera from the Ægean Sea and the deep water of the Mediterranean. Unfortunately this interesting catalogue is not illustrated.

Magnified 300 diameters:—

Figs. 1 & 2. Ptygostomum Orphei. From 840 feet. = *Globigerina bulloides*, rough shell.

Figs. 3 & 4. Phanerostomum atlanticum. From 6480 feet. *Glob. cretacea*, smooth.

Figs. 5 & 6. Globigerina ternata. From 840 feet. *Glob. bulloides*, ordinary heaped var.

Fig. 7. Spiropleurites nebulosus. From 10800 feet. *Pulvinulina repanda*, outspread form.

Fig. 26 represents a small *Globigerina* on a living *Conferva* (*Hygrocrocis Erebi*) from 12000 feet (about 2¼ miles) depth.

§ 9. *Volcanic May-dust, of May* 1812; *Barbadoes, West Indies.* (Monatsb. 1850, p. 359.)

Pl. XXXVIII. XXI. fig. 22. Rotalia globulosa. This appears to be a *Globigerina.*

§ 10. *Halibiolithic Volcanic Mud, Moya, Scheduba, Eastern Archipelago.* (Monatsb. 1846, pp. 171, 207.)

Pl. XXXVIII. XXIII. fig. 1. Rotalia globulosa. *Planorbulina.*
fig. 2. Textilaria leptotheca. *Virgulina Schreibersii*, Cz.
fig. 3. T. globulosa. *Text. globulosa*, Ehr.
fig. 4. Textilaria. *T. gibbosa*, D'Orb.
fig. 5. T. aculeata. *T. subangulata*, D'Orb.

§ 11. *Storm-dust.*

Pl. XXXIX. fig. 140. Textilaria globulosa. Small *T. gibbosa* or *T. globulosa.*

§ 12. *Sirocco-dust in Malta,* 1830.

Pl. XXXIX. III. *e.* Rotalia globulosa (senaria?). This is probably a *Globigerina*; but perhaps it is *Planorb. globulosa.*

§ 13. *Coloured Rain in Ireland, April* 14, 1849. (Monatsb. 1849, p. 200.)

Pl. XXXIX. XIV. *g.* Textilaria globulosa? This seems to be either a small rough-shelled *T. gibbosa*, or a *Globigerina* of irregular shape.

XX. MISCELLANEOUS FOSSIL FORAMINIFERA.

§ 1. *Polycystina-deposits of Barbadoes and Nicobar Islands*[*].

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[*] We refer the student to the beautiful plates of Dr. Conrad Schwager's memoir on the fossil Foraminifera of Kar Nikobar ('Novara-Expedition,' Geol. Theil, vol. ii. 1864, and 'Quart. Journ. Geol. Soc.' vol. xxviii. p. 125) for more abundant illustrations.

(Monatsb. 1846, p. 382, with illustrations; 1847, pp. 40–60; 1850, p. 476, &c. Schomburgk, 'History of Barbadoes,' 1848, p. 556, pls. 1, 2, p. 560.)

Pl. XXXVI. fig. 67. Planulina mica. Young *Planorbulina.*
fig. 68. Rotalia? *Planorbulina ammonoides.*

§ 2. *Nummulitic Limestone of Traunstein, Bavaria.* (Monatsb. Juli 1854.) Magnified 300 diam.

Pl. XXXVII. IV. 1. Guttulina turrita? *Verneuilina pygmæa* (Egger).
2. Mesopora chloris. (A green internal cast.) Some early segments of a *Haplophragmium.*
3. Planulina ammonis. *Operculina.* Compare *Op. lævis*, Gümbel, 1868, 'Foram. nordalp. Eocängeb.' pl. ii. fig. 113.
4. Rotalia rudis. Obscure; probably a prickly *Globigerina* coated with calcareous granules.

§ 3. *Pläner (Lower Chalk) Limestone, Teplitz, Bohemia.* (Monatsb. 1844, p. 414.) Magnified 300 diam.

Pl. XXXVII. VI. 1. Cenchridium oliva. An entosolenian *Lagena globosa.*
2. Proroporus cretæ? Probably a *Polymorphina.*
3 & 4. Rotalia globulosa tenuior. } *Globigerina.*
5. —— pertusa? }
6. Textilaria globulosa. } *Text. globulosa.*
7. —— —— ampliata. }

§ 4. *Hornstone (Cretaceous) pebble, Delitzsch, Saxony.* (Abhandlungen, 1836, p. 110 &c. pl. i.)

Pl. XXXVII. VII. 12. Textilaria globulosa. (A cast; magn. 100 diam.) Indeterminable.

Together with Xanthidia, Peridinia, &c.

§ 5. *Hornstone of the Coral-rag, Cracow.* (Monatsb. 1836, p. 196; 1843, p. 161; Abhandl. 1838, pp. 39, 76, 78.) Magnified 300 times linear.

Pl. XXXVII. VIII. 5. Nodosaria urceolata, 1838. A cast. *Nodosaria.*
6. Soldania elegans, 1838. A cast. *Cristellaria.*

Together with Xanthidia &c.

§ 6. *Yellow Jurassic Melonia-limestone from the Kaiserstuhl, Baden.* (Monatsb. 1843, p. 105.)

Pl. XXXVII. IX. A. A small piece, of the natural size, consisting of minute, globular, uniform bodies, lying in contact without calcareous cement. Fig. 1, *Borelis* (*Melonia*) *sphæroidea* (1842); figs. 2 & 3, sections. Magnified 20 diam. These have externally the appearance of *Alveolinæ*, prolately spheroidal in shape; the internal structure, however, though obscure, is not that of *Alveolina* (*Borelis* of Montfort and Ehrenberg), but is like that seen in *Fusulina*, *Endothyra*, and *Involutina*. Regarding Ehrenberg's specimens as *Endothyra*, and taking the rock for Jurassic, these are the youngest known of that genus*.

§ 7. *Yellow Jurassic Melonia-limestone, York, England.* (Monatsb. *l. c.*)

This is said to have the same appearance as IX. A., but to differ by containing some few extraneous objects, such as B. 1, *Nodosaria*, sp.?; 2, *Textilaria*, sp.?; 3, *Cypris*? These are figured of the natural size. Figs. 1 & 2 are clearly as stated. Fig. 3 is a simple, convex, oval object, possibly a *Cytherella* (?). As to the presumed Alveoline character of this Oolite we have no further evidence than the statement quoted above.

§ 8. Pl. XXXVII. IX. C. A brown "Melonia-limestone" from the Oolites of Bath is also alluded to, and a minute *Trochus* or *Pleurotomaria*? is figured from it (C. 1). There is, however, no figured evidence of the presumed Alveoline character of this rock.

§ 9. *Melonia- and Alveolina-limestones and hornstones of Russia.* (Monatsb. 1842, p. 273; 1843, pp. 79, 106.) *A white friable Bellerophon-limestone from Witegra on the Onega Lake.*

Pl. XXXVII. X. A. A piece figured nat. size. Figs. 1–4, *Textilaria palæotrochus*, nat. size and 4 diam. This is a *Valvulina* (compare XI. 12 & 13). Together with small Polyzoan(?) stems (figs. 5 & 6).

X. B is a similar rock, with minute helicoid shells (B. 1, *Euomphalus? nanus*, and B. 2, *Eu.? inversus*), which are much like *Spirorbis*.

§ 10. *Melonia- and Alveolina-hornstone of the Mountain-limestone of the Pinega (Dwina), Archangel.* (Monatsb. 1842, p. 273; 1843, p. 106.)

Pl. XXXVII. X. C. A piece, nat. size. C. figs. 1–4, *Borelis prin-*

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* In a sketch of the range of Foraminifera in time, by one of us, in the 'Proceed. Geol. Assoc.' vol. iii. pp. 180 & 182, *Fusulina* was inadvertently made to take the place of *Endothyra* in this Jurassic stage.

cepe, nat. size and magn. 4 diam. Ovoid in shape. Figs. 5, *a*, *b*, *Alveolina montipara*, nat. size and magn. 4 diam. Fusiform. [In the plate, fig. 5, outline or longitudinal section, nat. size; fig. 6, longitudinal section, opened by weathering, magn.] There can be no doubt of these shells being (fig. 5) *Fusulina cylindrica*, Fischer, and (fig. 4) its short sphæroidal variety.

§11. *Melonia-hornstone of the Mountain-limestone of Witegra.*

Pl. xxxvii. x. d. A piece, nat. size. d. figs. 1–4, *Borelis sphæroidea?* (1842), nat. size, and views and section magn. Very small, oblately spheroidal, deeply and evenly furrowed longitudinally; chambers small (or nearly filled), decidedly Fusuline in character. Figs. 5, 6, *B. constricta*, nat. size and magn. Such a *Fusulina* as this has been found fossil in the Arctic Regions[*]. Figs. 7–9, *Alveolina prisca* (1842); nat. size and magn. This is a *Fusulina* like c. 5. Figs. 10, 1 *a–f*, represent *Borelis* (*Melonia*) *melo*, from the Karst, near Trieste, for comparison. This is a true simple *Alveolina*, with a section very different from that of any of the above.

§12. *Hornstone of the Mountain-limestone, with* Spirifer mosquensis, *from Tula, Russia.* (Monatsb. 1843, pp. 79, 106.)

Pl. xxxvii. xi. a–d. The material variously shown.

Figs. 1, 2. *Alveolina prisca?* These are internal casts of *Fusulina cylindrica*; but the shape of the chambers is not so definitely quadrangular as in figs. 5 & 8. This may be due either to mineralization or to some obliquity in the section.

Fig. 3. *Borelis labyrinthiformis* (1843). A vertical section of the internal cast of a *Fusulina*, of an oblate-spheroidal shape.

Figs. 4, 5. *B. palæophus.* Casts of a *Fusulina*, with short alar prolongations of the chambers, and therefore to some extent Nummuline in shape, being discoidal with keeled edge.

Fig. 6. *B. palæophacus.* A cast of a similar but thicker *Fusulina.*

Figs. 7, 8. *B. palæosphæra.* Casts of a somewhat similar *Fusulina*, but barrel-shaped, having considerably produced alæ. In shape it corresponds with x. d. 1–4.

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[*] *Fusulina hyperborea*, Salter, in Belcher's 'Arctic Voyage,' 1855, vol. ii. p. 380, pl. xxxvi. figs. 1–3.

Fig. 9. *Grammostomum bursigerum.* Embedded cast of a *Textilaria* (to all appearance), with oval segments.

Fig. 10. *Nodosaria index.* Chamber-casts of a doubtful Foraminifer, in a row, with indications of a narrow straight shell, but showing no stolons.

Fig. 11. *Rotalia antiqua.* A rotaliform *Endothyra*; with chamber-casts like those of small *Planorbulinæ* (Mantell, Philos. Transact. 1846, pl. xxi.), and at the same time like those of Phillips's *Endothyra Bowmani* (Proc. Geol. Polytech. Soc. W. Riding Yorkshire, 1846, vol. ii. p. 277, pl. vii. fig. 1).

Fig. 12. *Tetrataxis conica* (1843); fig. 13. *T. conica?*, side view ("compare *Textilaria palæotrochus*"). As before intimated, this is a *Valvulina*, or at least a Valvuline modification of *Trochammina.*

Fig. 14. *Textilaria falcata.* Probably the edge view of fig. 17.

Fig. 15. *T. lagenosa.* The same as fig. 9.

Figs. 16 & 16*. *T. lunata* (1843). Apparently a broad pyramidal *Textilaria.*

Fig. 17. *T. recurvata.* Side view of *T. falcata*, fig. 14.

Forms similar to figs. 11, 12, 13, 14, and 17, besides others, have been found in the Mountain-limestone of England and Scotland by Messrs. Tennant, Darker, Phillips, Sorby, Harkness, Holl, Young, Moore, and Brady. The last-named has made a preliminary notice of them in the Brit. Assoc. Report for 1869, Trans. Sect. p. 381, and has elaborated one form in particular (*Saccammina Carteri*) in the Ann. Nat. Hist. ser. 4, vol. vii. p. 177 &c., pl. xii. See also "Monogr. *Polymorph.*," Linn. Soc. Trans. vol. xxvii. p. 199.

Fusulina.—With regard to the Fusuline specimens, Prof. Ehrenberg has evidently taken *Alveolina melo*, var. β (F. & M.), the *Melonia sphæroidea* of De Blainville (1824), as the type for those having a prolately spheroidal shape. This is also the *Borelis melonioides* of De Montfort (1808); hence the use also of the latter generic term†. But the Carboniferous specimens are not of this genus, and had been rightly discriminated by Fischer de Waldheim‡.

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† For a bibliographic history of *Alveolina*, see our memoir in Ann. Nat. Hist. ser. 3, vol. viii. pp. 161 &c.

‡ 'Oryctograph. Moscou,' 1830, p. 17, pl. xiii. Figs. 1–5 illustrate his *Fusulina cylindrica*; and figs. 6–11 are devoted to his *F. depressa*, which is the same as *F. cylindrica*, but showing a different aspect of interior, being opened at a different portion of the surface by weathering. See also D'Orbigny in 'Geol. Russia, &c. vol. ii. p. 15; and D'Eichwald's 'Lethæa Rossica,' 5^e livr. 1859, pp. 349 &c.

In treating of *Fusulina* in the Ann. Nat. Hist. ser. 3, vol. viii. p. 166 (1861), we regarded it as an *Alveolina*; but Dr. Carpenter's researches have settled its higher rank as a hyaline and tubuliferous shell near *Nonionina* and *Nummulina*[*], as intimated by D'Orbigny. Prof. Ehrenberg seems to have adopted the terms "*Alveolina*" and "*Borelis*" for the long and short *Fusulinæ* respectively[†]. If arranged in order, according to the amount of compression or the diminishing length of axis, the *Fusulinæ* figured in the plate before us would stand thus:—

1. Alveolina prisca. x. d. 7–9. } Fusiform. The same as Fischer's *Fusulina cylindrica* and *F. depressa.*
2. —— montipara. x. c. 5, *a*, *b*. }
3. —— prisca? xi. 1, 2. Long barrel-shaped.
4. Borelis constricta. x. d. 5, 6. Cylindrical, but constricted in the middle.
5. —— princeps. x. c. 1–4. Ovoid.
6. —— sphæroidea. x. d. 1–4. } Oblately spheroidal; barrel-shaped.
7. —— palæosphæra. xi. 7, 8. }
8. —— labyrinthiformis. xi. 3. Deeply oblate; thick disk with rounded edges.
9. —— palæophacus. xi. 6. Biconvex, with flattened faces; a disk with attenuate margin.
10. —— palæophus. xi. 1–5. Lenticular.

Thus, with every possible gradation of shape between them, the longitudinal section of the first is of the same outline as the vertical cross section of the last; whilst all present the same spiral arrangement of chambers (subquadrangular in section) when exposed by a median section across the long specimens, and parallel to the two faces in the discoidal and lenticular forms.

Fusulina cylindrica has been found in the Carboniferous rocks on the Ohio[‡] and of Upper Missouri (Marcou, 'Geol. Map U. S. and Canada,' text p. 36, 8vo, Boston, 1853; and Meek and Hayden, 'Palæontol. Upper Missouri,' 1865, pl. i. figs.

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[*] 'Introd. Study Foram.' 1862, p. 304 &c.; 'Month. Microscop. Journ.' 1870, p. 180.

[†] We are obliged to come to this conclusion, although our respected author had a decidedly different opinion in 1842. In the Monatsb. 1842, p. 274, he states that "1. *Melonia (Borelis) sphæroidea*, 2. *B. constricta*, 3. *B. princeps* (2 lines long), and 4. *Alveolina prisca* (1 line long, fusiform), occurring mixed up together in the white Carboniferous Miliolite-limestone of the Oneida Lake, are very different as to species from the evidently allied *Fusulinæ* of Russia."

[‡] De Verneuil, 'Silliman's Amer. Journ.' ser. 2, vol. ii. 1846, p. 293; Bullet. Soc. Géol. France, ser. 2, vol. iv. pp. 682, 684, & 708.

6*a*–6*i*). Also in California (Meek and Gabb, 'Geol. Surv. California, Palæont.' vol. i. 1864, p. 4, pl. ii. fig. 2), together with *F. gracilis* (fig. 1, p. 4) and *F. robusta* (fig. 3, p. 3). Abich found his *Fusulina sphærica* in the Caucasus: "Vergleich. Grundzüge Kaukas." &c., Mém. phys.-math. Acad. St.-Pétersb. vol. vii. pl. iii. fig. 13. B. F. Shumard found a Permian *Fusulina* (*F. elongata*) in New Mexico and Texas: Transact. Acad. St. Louis, vol. i. no. 2, 1858, p. 297; see also Hayden's 'Reports.' *F. robusta* has also been found in the Upper Carboniferous Limestone of the Southern Alps (Canal-Thal, Uggowitz). Prof. Suess regards it as the same as *F. sphærica*, Abich, and notes its occurrence, with *F. cylindrica*, in Russia[*].

There can be little doubt, with the evidence of gradational forms given in the 'Mikrogeologie,' pl. xxxvii., that all these and even other *Fusulinæ* may belong to one and the same zoological species. It is highly probable also that, on strict comparison, one and the same variety would be found to have claim to two or more of the names quoted above and in the foregoing list, made from the 'Mikrogeologie.'

In a specimen of white *Fusulina*-limestone, brought from Russia by the late Sir R. I. Murchison, we have found well-characterized fragments of *Dentalina communis* and a conical *Valvulina*. Such a form, recent, passes into *Trochammina squamata*; and *Tr. inflata* passes into *Lituola*; and *Lituola*, through *Trochammina*, becomes *Involutina* and *Endothyra*[†]. This low Rotaliiform shell (*Endothyra*) occurs in specimens collected by Dr. Holl from some clay-seams of the English Carboniferous Limestone, in sections of Carboniferous Limestone made by Prof. Phillips, of oolitic Mountain-limestone made by Mr. H. C. Sorby, and in several other collections. As *Valvulina* passes gradually into *Trochammina* by traceable links (Brady), and as the last and *Involutina* are closely related, we are not surprised to find a variety of modifications, even Textilariiform, of this low group in the Palæozoic strata, and, on the other hand, Endothyran modifications higher up in the series, as Ehrenberg's Jurassic "*Borelis sphæroidea*" (IX. A. 1–3) above noticed (p. 257).

Miscellaneous Fossil Foraminifera figured by Ehrenberg in the 'Mikrogeologie.'

I. *Barbadoes* (*late Tertiary*).

Planorbulina (young), *and* Pl. ammonoides (*Rss.*).

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[*] See Suess's valuable note on the distribution of *Fusulina* in America, Europe, and Armenia, Proc. Geol. Inst. Vienna, Jan. 4, 1870; Quart. Journ. Geol. Soc. vol. xxvi. Miscell. p. 3.

[†] See above, p. 259; also H. B. Brady's notes on these Foraminifera, Ann. Nat. Hist. ser. 4, vol. vi. pp. 50–52.

2. *Nummulitic Limestone, Traunstein, Bavaria.*
   1. Haplophragmium.
   2. Verneuilina pygmæa (*Egger*).
   3. Globigerina?
   4. Operculina ammonis (*Ehr.*).

3. *Pläner-Kalk, Teplitz, Bohemia.*
   1. Lagena (Entosolenia) globosa (*Montag.*).
   2. Polymorphina?
   3. Textilaria globulosa, *Ehr.*
   4. Globigerina.

4. *Hornstone (Cretaceous), Saxony.*
   1. Textilaria globulosa, *Ehr.*

5. *Coral-rag, Cracow.*
   Nodosaria *and* Cristellaria.

6. *Jurassic Limestone, Kaiserstuhl, Baden.*
   1. Endothyra sphæroidea (*Ehr.*).

7. *Jurassic Limestone, York, England.*
   Nodosaria *and* Textilaria.

8. *Jurassic Limestone, Bath, England.*

9. *Carboniferous Limestone, Witegra, Russia.*
   1. Valvulina (Tetrataxis) palæotrochus (*Ehr.*).

10. *Carboniferous Hornstone of the Pinega, Archangel.*
    1. Fusulina cylindrica, *Fischer.*
    2. —— princeps (*Ehr.*). This is probably the same as *F. sphærica*, Abich, and *F. robusta*, Meek.

11. *Carboniferous Hornstone, Witegra, Russia.*
    1. Fusulina cylindrica, *Fisch.*
    2. —— constricta (*Ehr.*).
    3. —— sphæroidea (*Ehr.*).

12. *Carboniferous Hornstone, Tula, Russia.*
    1. Nodosaria? index, *Ehr.*
    2. Fusulina cylindrica, *Fisch.*
    3. —— palæosphæra (*Ehr.*).
    4. —— labyrinthiformis (*Ehr.*).
    5. —— palæophacus (*Ehr.*).
    6. —— palæophus (*Ehr.*).
    7. Textilaria bursigera, *Ehr.*
    8. —— falcata (*vel* recurvata), *Ehr.*
    9. —— lunata, *Ehr.*

10. Valvulina (Tetrataxis) palæotrochus (*Ehr.*).
11. Endothyra antiqua (*Ehr.*). Possibly the same as *E. Bowmani*, Phil.

We have now finished the critical examination of the illustrated Foraminifera so liberally and magnificently set forth in the 'Mikrogeologie.' There remain, however, some equally beautiful drawings and coloured engravings of Foraminifera and their internal casts in the 'Abhandlungen' of the Berlin Academy, illustrative of the great microscopist's researches in green sand resulting from the infillings of these minute shells and other little cavernous organisms and the subsequent decay of the enclosing tissues, and of his successful work in the artificial production of analogous casts. In the 'Monatsberichte' for 1858 are still later researches on such siliceous casts, with some illustrations. We proceed, therefore, with the examination of these plates, as part of the *Miscellaneous Fossil Foraminifera* figured by Dr. Ehrenberg.

§ 13. *On Green Sand* and its elucidation of Organic Life.* (Abhandl. preuss. Akad. Wiss. aus dem Jahre 1855, 4to, Berlin, 1856, pp. 85–176; read in July and August 1854, and in February, March, May, and July 1855.)

In this memoir are described foraminiferal shells and internal casts from:—

I. & II. 1. Tertiary glauconitic sand of Pontoise, France, p. 104; 2. Tertiary glauconitic sand of Pierre-Laie, near Paris, p. 105; 3. Tertiary green sand from Westeregeln, Hanover, p. 105; 4. Nummulitic Limestone of Traunstein near the Chiem-See, Bavaria, p. 105; 5. Nummulitic Limestone of Montfort, Département des Landes, France, p. 106; 6. Nummulitic Limestone of Fontaine-de-la-Medaille, near Montfort, p. 107; 7. Green sand from beneath the *Zeuglodon*-limestone, Alabama, North America, p. 107; 8. Chloritic Limestone of the Pläner, near Werl, Westphalia, p. 107; 9. Upper Greensand, Compton Bay, Isle of Wight, p. 109; 10. Greensand of Haldon Hill, Exeter, p. 109; 11. Upper Greensand, Handfast Point, Swanage Bay, England, p. 109; 12. Lower Greensand, Handfast Point, p. 110; 13. Gault, Escragnolles, Dép. du Var, France, p. 110; 14. Neocomian, Lales, Dép. du Var, p. 110; 15. Loose green sand of the Middle Jurassic beds near Moscow, p. 111; 16. Compact green sand of the Jura, near Moscow, p. 111; 17. Lower Silurian green sand of St. Petersburg, p. 112.

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* See also Prof. J. W. Bailey's Memoir "On the Origin of Green Sand, and its formation in the Oceans of the present Epoch," in the Quart. Journ. Microsc. Soc. no. xviii., 1857, pp. 83–87.

III. "Remarks on the green sand of the *Zeuglodon*-limestone of Alabama" (read February 1855), pp. 112–116. IV. "New advance of knowledge of the green sand, and on the abundant brown-red and coral-red stone casts of the Polythalamian Chalk of North America" (read March 1855), pp. 116–129. V. "Further recognition of the higher organization of the Polythalamia by means of their ancient stone casts" (read May 1855), pp. 130–145. VI. "The successful exposition of perfect stone casts of Nummulites, with abundant organic structure" (read July 1855), pp. 146–148. VII. "The successful transparent colouring of colourless organic siliceous bodies for microscopical purposes" (read July 1855), pp. 148–157. The explanation of plates, pp. 158–176.

Plate I. figs. I.–III. represent chlorite &c.

Fig. IV. A group of green siliceous casts and portions of casts from the Nummulitic Limestone of the Traunstein. They are numbered (1–11) in the text, p. 159, and lettered (*a–l*) in the plate and its explanation, p. 160: fig. *a* ("Rotalia") probably belongs to an *Operculina*; fig. *g* ("Rotalia") may be part of the cast of a simple *Alveolina*. The others are very uncertain. Fig. V. (p. 160), *Nodosaria*, *Zeuglodon*-limestone, Alabama. Fig. VI., *Nodosaria monile* (Glauconitic Limestone, Montfort), =*N. pyrula*, D'Orb. VII. & VIII., *Nodosaria javanica* (Gua Linggo-manik, Java), has parallel grooves in each segment, and is a *Bigenerina* that had a set of internal ribs on the chamber-wall (incipient labyrinthic structure): see also a grooved cast in *Textilaria trilobata*, pl. IV. figs. XV., XVI. Fig. IX. *Vaginulina*, *Zeuglodon*-limestone. Fig. X. *Vaginulina subulata*, Glauc. Limestone, Montfort.

Pl. II. fig. I. (p. 161), *Textilaria globulosa*, Num. Limest. Traunstein. Fig. II., *Grammostomum attenuatum*, and fig. III., *Gr. angulatum* (Num. Limest. Montfort), are *Textilaria sagittula*. Fig. IV., *Text. euryconus?* (*Zeugl.*-l.), is *Text. agglutinans.* Fig. V., *Grammostomum* (*Zeugl.*-l.), is *Text. sagittula.* Fig. VI., *Oncobotrys buccinum* (*Zeugl.*-l.), is the cast of probably a *Polymorphina*, possibly of a *Bulimina.* Fig. VII., *Rotalia umbilicata* (Glauc. L. Montfort), is a young nautiloid form possibly Rotaline, probably Operculine. Fig. VIII. (p. 162), *Mesopora chloris* (Traunstein), is an *Operculina*, and not the same as is figured in the 'Mikrogeologie,' which is a *Haplophragmium* (*Lituola*). Fig. IX., *Planulina micromphala* (*Zeugl.*-l.), is *Rotalia Beccarii.* Fig. X., *Phanerostomum?*, and fig. XI., *Planulina polysolenia* (*Zeugl.*-l.), are *Planorbulina vulgaris.* Fig. XII., *Cristellaria eurythalama* (*Zeugl.*-l.), is a *Lituola* (*Haplophragmium*). Fig. XIII. (p. 163), *Globigerina crassa* (*Zeugl.*-l.), is *Glob. bulloides.* Fig. XIV. *Geoponus zeuglodontis* (*Zeugl.*-l.), is *Planorbulina vulgaris**.

Pl. III. (p. 164), fig. I.–IV., *Nonionina? bavarica* (Traunstein), is a young *Amphistegina.* This is the earliest recorded appearance of the genus in the geological series. Fig. V., *Rotalia* (*Zeugl.*-l.), is a young *Operculina* or *Nummulina?* Fig. VI., peculiar triangular dentate cast (*Zeugl.*-l.), is like the septal plane of a *Polystomella.* Figs. VII.–IX. (p. 165), *Amphistegina javanica*, and fig. X., *Heterostegina clathrata*, both from the Orbitoidal Limestone of Gua Linggo-manik, Java, are both the same *Amph. javanica.*

Pl. IV. (p. 166), fig. I. (p. 167), not named, is an *Amphistegina* with parasitic borings. Figs. II.–VII. (p. 168), *Orbitoides Prattii.* Figs. VIII.–X., *Orbitoides javanicus*, and fig. XI., *Orbitoides microthalama*, both from Java, are the same *Orbitoides.* Fig. XII., *Cyclosiphon?*, from Java, is part of an *Orbitoides* (referred elsewhere by Ehrenberg to *Orb. Mantelli*). Fig. XIII. (p. 169), *Spiroplecta?* (*Zeugl.*-l.), is a *Spiroplecta.* Figs. XIV.–XVI., *Textilaria trilobata* (Java, Orb. L.), is an interesting sublabyrinthic *Text.*, already referred to (p. 264). Fig. XVII., *Spiroloculina?* (Traunstein), seems to be a *Quinqueloculina.* Fig. XVIII., *Quinqueloculina*, and fig. XIX., *Quinqueloculina* (Traunstein), are undeveloped young *Miliolæ.* Fig. XX., *Quinq. saxorum* (Calcaire grossier, Pontoise), is a *Quinqueloculina*, but not of that species which has a thick shell grooved within. Fig. XXI., *Triloculina* (Orb. L., Java), has been parasitically bored. Fig. XXII., *Spiroloculina* (Orb. L., Java), is very interesting in having lateral stolons from segment to segment, showing a prolepsis of the more complicated and closely related *Orbitolites*, the outside of the quasi-annular segments being multistoloniferous. These supernumerary stolons begin by few and become many in later segments. Fig. XXIII. *Cerithium?* (*Zeugl.*-l.). Fig. XXIV. *Spirillina?*, or young Mollusk?, or *Spirorbis?* (Alabama); decidedly a young Mollusk.

Pl. V. figs. I–VIII. *Nummulites striata* (Couizac, Dép. de l'Aude); fig. VII. is *Nummulina planulata* (Lam.). Figs. IX., X. (p. 171), *N. Murchisoni* (Traunstein). Fig. XI. *N. Dufrenoyi* (Traunstein). Fig. XII., *Polystomatium?* (Traunstein), is a *Polystomella.* Figs. XIII.–XV., *Polystomatium lepactis* (Orb. L., Java), is *Polystomella craticulata* (compare pl. XVI. fig. 9, of 'Introd. Study Foram.' 1862). Fig. XVI. (p. 172), *Physomphalus porosus* (Orb. L., Java), is *Operculina.* Fig. XVII. *Alveolina* (Java).

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* Two casts of this species from North-American Tertiary beds were figured by Prof. Bailey in Amer. Journ. Sc. 1845, vol. xlviii. no. 2, pl. iv. figs. 30, 31.

I. *Foraminifera from the Nummulitic Limestone, Traunstein, Bavaria.* See also above, page 256.

1. Textilaria globulosa, *Ehr.*
2. Polystomella.
3. Operculina.
4. Amphistegina.
5. Nummulina Murchisoni.
6. —— Dufrenoyi.
7. Alveolina.
8. Quinqueloculina?

II. *Nummulitic Limestone, Montfort, France.*

1. Nodosaria pyrula, *D'Orb.*
2. Vaginulina subulata, *Ehr.*
3. Textilaria sagittula, *Defr.*
4. Operculina?

III. *Nummulitic Limestone, Couizac, France.*

1. Nummulina striata, *D'Orb.*
2. —— planulata (*Lam.*).

IV. *Zeuglodon-beds, Alabama.*

1. Nodosaria.
2. Vaginulina.
3. Polymorphina.
4. Textilaria agglutinans, *D'Orb.*
5. —— sagittula, *Defr.*
6. Spiroplecta.
7. Globigerina bulloides, *D'Orb.*
8. Planorbulina vulgaris, *D'Orb.*
9. Rotalia Beccarii (*Lin.*).
10. Polystomella?
11. Operculina?
12. Haplophragmium.

V. *Orbitoides Limestone, Java.*

1. Textilaria trilobata, *Ehr.*
2. Bigenerina javanica (*Ehr.*).
3. Polystomella craticulata (*F. & M.*).
4. Orbitoides javanicus, *Ehr.*
5. —— Mantelli? (*Morton*).
6. Operculina.
7. Amphistegina javanica, *Ehr.*
8. Alveolina.
9. Spiroloculina (stoloniferous).
10. Triloculina.

Pl. VI. Lower Silurian green sand of Petersburg. Fig. I. *a* (p. 173), *Textilaria globulosa?*, in a piece of brownish siliceo-calcareous green sandrock (treated with acid), from under the Orthoceratite Limestone, Narwa, and fig. *b*, *Guttulina*, are both small *Textilariæ*. Fig. *c*, *Rotalia*, from the same; a Rotaline or Endothyran form. Fig. II. (p. 174), a thin slice of the same rock (green), showing minute shaped bodies; 19, *Solenolithis simplex*; 20, *Dermatolithis subtilis*; 21, *D. granulatus*: said to be brownish calcareous and microscopic, belonging to the structure of *Obolus*, and abundantly scattered throughout the green sandstone of Narwa.

Pl. VII. Yellow, red, and brown sand casts of the yellowish Chalk of Alabama, equivalent to that of the Mississippi. Figs. 1, 2 (p. 175), *Textilaria americana*. Fig. 3, *T. striata*. Figs. 4, 5, *Guttulina turrita α, β*, are *Verneuilina pygmæa*. Fig. 6, *Spiroplecta americana?* Fig. 7, *Textilaria americana?* Fig. 8, *T. euryconus?*, is *T. agglutinans*. Fig. 9, *T. globulosa?* Fig. 10 (p. 176), *Dimorphina* (*Text.?*) *saxipara*, is *Text. globulosa*. Fig. 11, *Phanerostomum hispidulum*, and fig. 12, *Ph.?*, are *Globigerina cretacea*. Fig. 13, *Rotalia?*, is a young limbate *Planorbulina*. Fig. 14, *Phanerostomum senarium?*, fig. 15, *Ph. porulosum?*, and figs. 16, 17, *Ph. dilatatum*, are *Globigerina cretacea*. Figs. 11 & 12 have more chambers than figs. 14–17, but belong to the same species.

Foraminifera from the Chalk, Alabama.

1. Textilaria agglutinans, *D'Orb.*
2. —— globulosa, *Ehr.*
3. —— striata, *Ehr.*
4. —— americana, *Ehr.*
5. Spiroplecta americana (?), *Ehr.*
6. Verneuilina pygmæa (*Egger*).
7. Globigerina cretacea, *D'Orb.*
8. Planorbulina, young.

§ 14. "*On organic siliceous sand, and Herr Ignatz Beissel's observations on such beds near Aix-la-Chapelle*" (Monatsber. 1858, pp. 118–128). See also 'Literary Gazette,' 1857, p. 1220, for a notice of Herr Beissel's researches on the Glauconiferous sand-grains of Aix-la-Chapelle.

§ 15. I. "*On the progress of knowledge of important microscopic organic forms in the lowest Silurian clay-beds near St. Petersburg*" (Monatsber. 1858, pp. 295–311). See also 'Neues Jahrb. für Min.' &c., 1858, 5. Heft; Murchison's 'Siluria,' edit. 1867, p. 356; Bigsby's 'Thesaurus Siluricus,' 1868, p. 6; and "Monogr. *Polymorph.*," Trans. Lin. Soc. vol. xxvii. p. 199.

II. "*On further important microscopic organic forms from the oldest Silurian clay near St. Petersburg.*" With a plate. (Monatsber. 1858, pp. 328 &c., pl. i.)

A (p. 306). White marl-casts or marl-morpholites. 1. *Miliolina?*, and 2. *Textilarina?*

B. Green siliceous internal casts.

3. Vaginulina?, in pl. I. fig. i.
4 (p. 307). Nodosaria?, fig. ii.
5. Textilaria? imitatrix, fig. iii.
6. Polymorphina abavia, fig. iv.
7. P. avia, fig. v.
8 (p. 308). Guttulina silurica, fig. vi.
9. Rotalia palæotrias. } Figs. vii. & viii. No. 9 is omitted
10. R. palæotetras. } in the later list.
11 (p. 309). R.? palæoceros. ("Like *R. Hemprichii*," 'Mikrog.' pl. xxxiv. f. 62.) Fig. ix.
12. Dexiospira triarchæa, fig. x.
13. D. hexarchæa, fig. xi., *a*, *b*.
14 (p. 310). Aristerospira octarchæa, fig. xii.
15. Nonionina? archetypus, fig. xiii.
16. Spirocerium priscum. ("New genus near *Spirobotrys*, but has not the two openings in the later chambers.") Fig. xiv.

These figured glauconitic grains are magnified 56 diam. Their relationship to Foraminifera is very uncertain. They are not nearly so clear and definite as the usual inner moulds of foraminiferal shells; but, like the green grains in our Upper and Lower Greensand, some may be such casts, and many are probably of concretionary or derivative origin. As Dr. Ehrenberg at first stated, little can be said of them except that they have Rotaline and Textilarian appearances. Some may have belonged to *Eozoon* (as fig. i.). Figs. iv., v., vi. look Bulimine; vii., viii., x. look Globigerine; ix. somewhat Nonionine; xi., xii., more or less Rotaline. They are all doubtful.

C (p. 311). "Calcareous shale casts from the Devonian strata near St. Petersburg."

17. Miliola (Holococcus) Panderi. ("*Trochiliscus*, Pander: orbicular or oval; hollow; compressed in the middle or on the side; with a single opening; furrowed longitudinally with 18–20 sulci, which in some cases are spiral.") =*Lagena?*

APPENDIX.

Generic names of Foraminifera *used by* Ehrenberg, *and their probable equivalents.*

Allotheca, 1854. *Globigerina?*
Alveolina, *D'Orb.* *Alveolina*; *Fusulina.*
Amphisorus, 1838. *Orbitolites* (old).
Aristeropora, 1859. *Planorbulina?*
Aristerospira, 1859. *Planorbulina?*
Aspidospira, 1844. *Planulina.*
Asterodiscus, 1838. = ?
Bigenerina, *D'Orb.* *Polymorphina.*
Biloculina, *D'Orb.* Adesoline *Quinqueloculina. Biloculina?*
Borelis, *Mtft.* *Alveolina*; *Fusulina*; *Endothyra.*
Calcarina, *D'Orb.* *Planorbulina?*
Cenchridium, 1843? Entosolenian *Lagena.*
Ceratospirulina, 1859. Dimorphous *Miliola?*; *Vertebralina?*
Cimelidium, 1859. *Valvulina?*
Clidostomum. Textilarian [*Reuss*].
Colpopleura, 1844. *Planorbulina.*
Coscinospira, 1838. *Peneroplis* and *Lituola.*
Cristellaria, *Lamk.* *Cristellaria*; *Planulina*; *Haplophragmium.*
Cyclosiphon, 1856. *Orbitoides.*
Dentalina, *D'Orb.* *Dentalina.*
Dexiospira, 1859. Indeterminable.
Dimorphina, *D'Orb.* Dimorphine *Virgulina.*
Encorycium, 1859. *Nodosaria.*
Frondicularia, *Defr.* *Nodosaria*; *Glandulina.*
Geoponus, 1838. *Polystomella*; *Planorbulina.*
Globigerina, *D'Orb.* *Globigerina.*
Grammobotrys, 1854. *Virgulina*; *Sphæroidina.*
Grammostomum, 1839. *Textilaria*; *Vulvulina*; *Bolivina*; *Virgulina*; *Polymorphina.*
Guttulina, *D'Orb.* *Verneuilina*; *Textilaria.*
Heterohelix (1843) changed to *Spiroplecta* (1844).
Heterostegina, *D'Orb.* *Amphistegina.*
Heterostomum, 1854. *Textilaria*; *Virgulina.*
Holococcus, 1859. *Lagena?*
Lenticulina, *Lamk.* *Planorbulina*; *Pulvinulina.*
Loxostomum, 1854. *Heterostomella*; *Vulvulina*; *Polymorphina.*
Megathyra, 1854. Mentioned in 'Mikrogeol.' p. 13, without figure or description.
Melonia, *Blainv.* *Fusulina*; *Alveolina.*

Mesopora, 1854. *Lituola* (*Haplophragmium*); *Operculina.*
Miliola, *Lamk.* *Lagena*; *Orbulina.*
Monetulites, 1856. *Nummulina.*
Nodosaria, *Lamk.* *Nodosaria*; *Bigenerina.*
Nonionina, *D' Orb.* *Nonionina*; *Rotalia?*; *Planorbulina?*; *Cristellaria?*; *Amphistegina.*
Omphalophacus, 1838. *Pulvinulina.*
Oncobotrys, 1856. *Polymorphina?*
Ovulina. *Lagena.*
Phanerostomum, 1854. *Globigerina.*
Physomphalus, 1856. *Operculina.*
Planularia, *Defr.* *Planularia.*
Planulina, *D' Orb.* *Planorbulina*, including *Planulina* and *Truncatulina*; *Globigerina*; *Rotalia*; *Pulvinulina*; *Nonionina?*; *Operculina*; *Cristellaria.*
Platyœcus, 1854. *Pulvinulina?*
Pleurites, 1854. *Sphæroidina?*; *Virgulina*; *Polymorphina?*
Pleurostomum. Textilarian [*Reuss*].
Pleurotrema, 1838. *Calcarina?*
Polymorphina, *D' Orb.* *Polymorphina*; *Bolivina*; *Virgulina*; *Textilaria.*
Polystomatium, 1856. *Polystomella.*
Proroporus, 1844. *Polymorphina*; *Bolivina*; *Textilaria.*
Prorospira, 1844. *Planorbulina.*
Ptygostomum, 1854. *Planorbulina*; *Globigerina.*
Pylodexia, 1859. *Globigerina.*
Pyrulina, *D' Orb.* *Pyrulina* (*Polymorphina*).
Quinqueloculina, *D' Orb.* *Quinqueloculina.*
Rhynchoplecta. Textilarian [*Reuss*].
Rhynchopleura, 1856. Textilarian?
Rhynchospira. Globigerine [*Reuss*].
Robulina, *D' Orb.* *Cristellaria.*
Rosalina, *D' Orb.* *Planorbulina*; *Globigerina.*
Rotalia, *Lamk.* *Globigerina*; *Planorbulina* and *Planulina*; *Pulvinulina?*; *Cristellaria*; *Operculina?*
Rotalina, *D' Orb.* *Pulvinulina.*
Sagrina, *D' Orb.* *Heterostomella.*
Selenostomum, 1859. Rotaline?
Siderospira. *Calcarina* [Reuss].
Soldania, *D' Orb.* *Cristellaria.*
Sorites, 1838. *Orbitolites.*
Sphæroidina, *D' Orb.* *Sphæroidina*; *Virgulina.*
Spirillina, 1841. *Spirillina*; *Cornuspira?*
Spirobotrys, 1844. *Planorbulina?*
Spirocerium, 1859. Indeterminable.
Spiroloculina, *D' Orb.* *Spiroloculina*; adelosine *Quinqueloculina.*

Spiroplecta, 1844 (*olim* Heterohelix). *Spiroplecta.*
Spiropleurites, 1854. *Pulvinulina.*
Strophoconus, 1844. *Bolivina*; *Virgulina.*
Synspira, 1854. *Synspira* (?).
Tetrataxis, 1854. *Tetrataxis* (*Valvulina*).
Textilaria, *Defr.* *Textilaria*; *Bolivina.*
Triloculina, *D'Orb.* *Miliola?*
Uvigerina, *D'Orb.* *Planorbulina?*
Vaginulina, *D'Orb.* *Vaginulina.*

XL.—*On the Habits of some Madeiran Spiders.*

By Frederick Pollock, Esq.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,

In the number of your Magazine for June 1865 there is an article by me on the *Epeïra Aurelia* spider.

I had some doubts, at the time I wrote it, upon one fact therein stated; and having had the opportunity of making further observations, in the season just passed, in Madeira, I find that I was mistaken in what I originally supposed to occur.

As it is an important point in arachnology, and as it differs from all Mr. Blackwall's observations, I should like to be able to contradict my former statement in the same publication in which it was made, and to add a few remarks on the economy of two other sorts of Madeiran spiders, which, if you will allow me, I will now proceed to do.

Epeïra Aurelia, now called *Nephila Aurelia.*

In the article above alluded to I said that the spider changes its skin for the last time about a week after making its fifth cocoon; but from more recent observations I have come to the conclusion, that there is no change of skin at all, after the spider becomes adult. This reduces the number of changes of integument to nine, in the female, viz. one in the cocoon and eight after leaving it. The male, on the other hand, has only four changes of integument after leaving the cocoon.

Unlike most spiders of the *Nephila* (*Epeïra*) kind, *N. Aurelia* does not make for itself any chamber to retire to when wishing to escape observation, but remains constantly in the centre of its web, and is therefore very easily watched. I have mentioned (in the previous article on this subject) that in the construction of this web there is always a space left between the adhesive spiral line, which extends from the circumference to tolerably near the centre, and the inadhesive centre part; and I have frequently seen the spider scramble through this opening, when frightened or anxious to get hurriedly from one surface of the web to the other. Various opinions and doubts have been advanced by arachnologists, upon the specific purpose which this open space is meant to subserve; but in this case the object appears plain enough—namely, to give a short cut, near the centre, between the opposite surfaces of the web.

But there is another reason which, I think, may account for spiders of the geometrical kind leaving the space just alluded to; and I will endeavour to explain it.

When any comparatively large insect is caught in their webs and carried away to be eaten, the spider generally bites away the lines surrounding the insect (in order to get it free); and thus a rent or hole must, of necessity, be made where the insect became entangled.

Now the strength of these webs depends mainly upon the radial lines, which are, of course, much closer together near the centre than near the circumference.

If a fly is caught near the latter, perhaps no radial line, or only one, need be broken, to get the creature away; whereas if it were caught very near the centre, two or three, at least, of the radial lines might have to be cut, and the web would be greatly weakened thereby. This may be the reason why the spiral adhesive line is not carried nearer to the centre.

The central space, which is devoid of adhesive lines, and in which it is undesirable that any thing should be caught, is much larger than is requisite for a resting-place for the spider. The real resting-place of inadhesive lines does not occupy the whole of this space; and hence the void; which there would be no use in filling up, apparently.

I may here remark that, owing to the adhesive property of the spiral lines so soon disappearing in Madeira, *N. Aurelia* makes, on an average, about two webs in every three days.

Lycosa Blackwallii.

This spider is described by Mr. J. Y. Johnson in the August and November Nos. of the 'Annals' for 1863. On the 6th of January, 1870, I dug out of a hole (of its own making, probably), in a soft sloping bank of earth, at an elevation above the sea of about 2000 feet, in Madeira, a half-grown female of *L. Blackwallii*; and none were ever found by me at a lower elevation, though I repeatedly searched for them in every direction. On the 9th of March it changed its skin; and in April I brought it to England, where it changed again on the 25th of that month, and again on the 30th of July, at which latter date it became adult.

It may here be seen that sixty-two days elapsed between the time of capture and the ensuing change; and how many days should be added to this, for the entire number between the two consecutive changes, it is impossible to determine. Only forty-seven days elapsed before another change took place, and ninety-six before the last one occurred. Now, during the time of the short interval (forty-seven days), the spider had less to eat than at any other period whilst in my possession (for it was shut up in a box in the hold of the ship during the voyage); and this diminution of food ought to have prolonged, I think, instead of shortening the time; and as all other circumstances during its captivity remained much about the same, the only way in which I can account for the shorter period, is from fright occasioned by the sea voyages, the transhipment at Lisbon, and the vibration on the railway and cab journeys. After it became adult, nothing particular occurred for a year and seven days, or till the 6th of August, 1871, when the spider made a cocoon, scantily supplied with yellow eggs, agglutinated together. This cocoon it attached to its abdomen, which it kept constantly elevated from the ground. It likewise encircled the cocoon with its fourth pair of legs, thus tenderly preventing its coming into contact with any thing. As this female had been in solitary confinement ever since it was half-grown, the eggs were not fecundated, I imagine.

On the 28th of September the creature dropped the cocoon from the abdomen; and this was just about the time that the young ones should have made their appearance, if the eggs had been good.

On the 15th of October I landed the spider again in Madeira; but, unfortunately, forgetting the mischief that ants are always ready to do there, I made no provision for protecting the creature from them, and the next morning I found that they had killed the spider and were busy in walking off with the eggs.

Lycosa ingens (Blackw.).

Having procured from the Deserta Grande some fine specimens of this large and handsome spider, in the early part of this year, and having provided suitable cages, with glass lids, for them, I was anxious to ascertain how large an animal the largest spider would take; and for this purpose I obtained some lizards about 3 inches long, including the tail. Three of these lizards were killed and devoured by one spider during the time I kept it.

They were eaten, bones, and head, and claws and all, the only remnant of the feast being a small ball about ¼ of an inch in diameter, which was cast aside at the bottom of the cage.

The islands of Madeira, Porto Santo, and Deserta Grande all lie within an area about fifty miles across. They have each its own peculiar large *Lycosa*, no two being alike; and it is a very remarkable fact that these *Lycosæ* vary in size inversely with the magnitude of the island in which they are found,—Madeira, the largest island, having the smallest *Lycosa*, and Deserta Grande, the smallest island, having by far the largest spider.

The mode of defence of all these varieties of *Lycosæ* is precisely the same. They elevate the thorax, raise the first pair of legs high up, and, opening wide asunder their falces, strike at and seize any object, such as the end of a pencil, which is presented to them, in a most formidable manner.

Circumstances unfortunately prevented my bringing this splendid spider away with me from Madeira, or I should have tried to watch and record the remainder of its existence.

Yours truly,
FREDERICK POLLOCK.

Thurlow, Clapham, S.W.
Sept. 12, 1872.

XLI.—*Remarks on* Crinodes Sommeri *and* Tarsolepis remicauda. By A. G. BUTLER, F.L.S., F.Z.S., &c.

IN the last Number of the 'Annals' C. Ritsema, of Leyden, accuses me of renaming an old and well-known species of moth, *Crinodes Sommeri*, with the new generic and specific names of *Tarsolepis remicauda*.

C. Sommeri is figured by Hübner in the second volume of his 'Sammlung,' pl. 197; on pl. 196 both sexes of another species (*C. Beschii*), of which we possess a series in the British Museum, are correctly figured. The latter is therefore the type of the genus *Crino*, subsequently altered to *Crinodes*, and is evidently so considered in Mr. Walker's catalogue.

Hübner states his figure to be a representation of a male insect, as we should naturally conclude from the fact of its possessing the male character of a well-developed anal tuft of radiating scales. My insect is also a male, and differs from *C. Sommeri*, as figured by Hübner, in the following generic and specific characters:—

Generic differences.

Crinodes Sommeri, Hübner.	*Tarsolepis remicauda*, Butler.
1. Male antennæ feebly pectinated, as in the other species of *Crinodes*.	1. Male antennæ bearing about forty-three well-developed pectinations.
2. Palpi long, slender, projecting considerably beyond the head.	2. Palpi short, robust, scarcely projecting beyond the head.
3. No abdominal tufts.	3. Two long tufts of carmine hairs at base of abdomen, beneath wings.
4. Body slender; abdomen apparently spinous, as in *Checupa* (Hadenidæ), P. Z. S. 1867, pl. vi. fig. 5.	4. Body very robust, almost clumsy; abdomen not spinous.

Specific differences.

1. Pale costal band of front wings restricted to centre of costa.	1. Pale costal band continuous from base to apex.
2. Pale basal patches represented only by usual elongation of basal scales.	2. Two distinct pale basal patches.
3. Inner margin of front wings waved as in the allied *C. fulgurifera*.	3. Inner margin of front wings slightly convex, not waved.
4. Hind wings comparatively short and rounded, with well-defined central black spot and three distinct continuous marginal lines.	4. Hind wings comparatively long and ovate, with ill-defined central spot; central marginal line converted into spots, none of the lines continued round margin.
5. Underside of wings dark, all the markings sharply defined.	5. Underside of wings pale, all the markings ill-defined.
6. Transverse band of front wings strongly angulated, so as almost to touch discoidal cell.	6. Transverse band of front wings scarcely waved, nearly parallel to outer margin.
7. Fringe of all the wings long.	7. Fringe of all the wings short.

The conclusion that I arrive at from the above comparison is that my insect is not identical either generically or specifically with Hübner's. It certainly is not a *Crinodes*; for it does not agree generically with the type, *C. Beschii*; and inasmuch as all the members of the genus *Crinodes*, so far as we know them, are from the New World, it is not at all improbable that the example from Rio Janeiro in Mr. Fry's collection may be the true *C. Sommeri*, and the Javan species a totally different insect, belonging to an allied genus, and on that account somewhat similar to it in pattern and coloration.

I therefore feel myself fully justified in retaining the generic and specific names *Tarsolepis remicauda* for Mr. Cornthwaite's insect; and I should recommend that this name be also attached to the Javan specimens examined by Herr Ritsema.

XLII.—*Preliminary Report on Dredgings in Lake Ontario.*

By H. Alleyne Nicholson, M.D., D.Sc., M.A., F.R.S.E., Professor of Natural History in University College, Toronto.

In consequence of the interesting discoveries made in the dredgings carried on in Lake Superior in the summer of 1871 in the U.S. steamer 'Search' (Reports of the Sec. of War, U.S. vol. ii.), I was induced to apply to the government of the Province of Ontario for a grant to be expended in prosecuting a similar series of dredgings in Lake Ontario, a lake which had hitherto never been explored by the dredge. With a praiseworthy appreciation of the value of such scientific researches, the necessary assistance was generously granted to me by the Provincial Government; and the results obtained are of a very satisfactory character. The short time, however, which has elapsed since the dredging was completed has not permitted more than the most hasty examination of the materials collected. In the following preliminary report, therefore, I shall merely state the general results which were obtained, reserving for a future occasion a detailed account of the animals which were collected.

The dredgings were all carried on in the later part of June and the early part of July, and were made partly from the yacht 'Ina' and partly from the steamer 'Bouquet.' They were entirely carried on by hand; and the dredges employed were such as are ordinarily used in sea-dredging. In dredging in deep water, however, a bag of embroidery canvas was attached outside the ordinary net—an addition rendered necessary by the extremely fine nature of the mud at great depths. Even with this precaution the dredge not unfrequently came up nearly or quite empty from great depths, its contents having been completely washed out. In deep water, also, a fifty-six-pound weight was attached to the rope, at a distance of about 12 feet above the dredge; and the same was necessary in shallow water where the weeds were very thick, in order to secure that the dredge should reach the actual bottom.

The dredgings were all carried on within a radius of ten miles from Toronto; and the following will show the general nature of the bottom at different depths, and the chief localities at which the dredgings were prosecuted.

In Toronto Bay itself numerous hauls were made, both from the yacht and the steamer, and the bottom proved very varied, though the depth is almost constantly from 2 to 3 fathoms. The greater portion of the bay, comprising the central part of its area, has a bottom which appears to consist uniformly of a tenacious, exceedingly fine, clayey mud, the temperature of which is comparatively low. All the shells in this clay are dead, but it contains numerous small Annelides of the genus *Sænuris*, along with many larvæ of a Dipterous insect allied to *Chironomus* or *Corethra*, the latter being very conspicuous from their brilliant red colour. The muddy bottom seems to be wholly destitute of weeds, and does not appear to encroach upon depths of less than 2 fathoms.

Towards the edges of the bay, where the depth diminishes to one and a half fathom or less, the bottom consists of sand, covered over considerable areas by a dense growth of weeds of different kinds. The chief varieties of bottom in this shallow zone are these:—1. Pure siliceous sand with dead shells, almost destitute of life. 2. Sandy mud with a dense growth of Charas, containing numerous *Gammari*, small leeches, larvæ of *Chironomus* and Ephemerids, with shells of *Unio*, *Cyclas*, *Paludina*, *Planorbis*, *Valvata*, *Melania*, *Pisidium*, and *Physa*. 3. Sandy mud, sometimes with peaty layers, supporting a dense vegetation of *Anacharis canadensis* and Charas. The life in these portions of the bay consisted of much the same animals as in the preceding, except that the *Gammari* were absent, unless in the occasional patches of Charas brought up by the dredge. In some places, in from one to one and a half fathom of water, the sand was crowded with *Uniones*, the dredge coming up completely packed with living and dead shells. This was especially the case at several points under the lee of the "island," a long, flat, insulated strip of land which forms the southern boundary of the bay, running parallel with the shore on which Toronto is built, at a distance of about a mile and three quarters from it.

Another series of dredgings was carried on from a point in the open lake, about eight miles to the south of Toronto, on a line extending to the Toronto rolling-mills, the depth varying from 40 fathoms at the southern end of the line to 3 fathoms at its northern extremity. The deep dredgings along this line were only partially successful, the dredge bringing up nothing but good-sized pebbles, all the finer materials having been washed out before it reached the surface. In about 15 fathoms the bottom was found to consist of a tenacious blue clay, distinctly laminated, and containing numerous broken-up stems of plants, along with small pebbles. No traces of life could be detected beyond a few minute Annelides belonging to the genus *Sænuris*. Another haul in 10 fathoms brought up the dredge full of sand and pebbles with no traces of life; and another in 8 fathoms showed a bottom of clear sand with dead shells of *Cyclas* and *Pisidium*, but devoid of all vestiges of animal or vegetable life.

Another series of dredgings was taken along a line extending in a south-west direction, from Toronto Point to a point about five miles out in the lake, the depths varying from 8 to 15 fathoms. In this case the bottom was found uniformly to consist of an exceedingly fine, bluish-grey, clayey mud, with numerous patches of a small bushy Alga (a species of *Cladophora*). The mud contained very numerous minute Annelides of the genus *Sænuris*, along with dead shells of *Cyclas*, *Pisidium*, and *Planorbis*; and the bunches of *Cladophora* yielded a large number of little Ostracode Crustaceans, and a few beautiful little Amphipods which are as yet undetermined.

Another series of dredgings was carried on still further to the south-west of the ground examined, in the series just mentioned, at a distance of about eight miles from the shore. The depth here varies from 30 to 45 or 50 fathoms; and the bottom was found to consist uniformly of a fine greyish mud, sometimes highly argillaceous, sometimes more or less arenaceous, with many small pebbles disseminated through it, and containing a few dead shells of *Planorbis* and *Pisidium*, and much broken-down vegetable débris. Every haul also brought up numerous specimens of a beautiful flesh-coloured Amphipod and a few minute Annelides; but no other traces of life were obtained. The Amphipods are referable to *Pontoporeia*, being apparently undistinguishable from *P. affinis* of the Swedish lakes; and I shall speak of them at greater length immediately.

Another series of dredgings were taken in Humber Bay, about four miles to the west of Toronto. Here the bottom, except close to the shore, consisted of a tenacious bluish-grey clay, sometimes with reddish patches in it. Vegetable life was very scanty; and animal life consisted entirely of many minute Annelides.

Lastly, an examination was made, partly with the dredge and partly by means of a hand-net, of the shallow water in the immediate neighbourhood of the "island" and of the extensive ponds which communicate with the lake. The bottom here consisted, for the most part, of a black mud composed almost entirely of decayed vegetable matter, and supporting a dense growth of Charas, *Vallisneria*, *Anacharis*, *Pontederia*, *Nymphæa*, and *Nuphar*. Animal life was naturally extremely abundant, comprising numerous examples of *Limnæa*, *Physa*, *Planorbis*, *Paludina*, *Cyclas*, *Pisidium*, and *Anodon*, along with two species of *Gammarus* and many small Ostracode Crustaceans, a few leeches (*Clepsine*), very many large scarlet water-mites, numerous aquatic insects (*Nepa*, *Gyrinus*, *Dy-*

ticus, and larvæ of *Chironomus*, *Libellula*, &c.), and a large number of young fishes (*Pimelodus*, *Perca*, &c.). Numerous Terrapins were also observed, and a single specimen of *Menobranchus*; but the latter unfortunately was not secured.

In the following list are indicated the chief forms of animal life which were obtained in these dredgings. As before remarked, time has in most cases not permitted of any specific determinations being made, and the species will be described at length in a subsequent notice. The microscopic species also have, in the meanwhile, been completely neglected.

ANNELIDA.

1. *Nephelis*, sp.

A small leech, nearly an inch in length when at rest, with an oblique posterior sucker, and of a liver-brown colour in life. Nearly allied to, if not identical with, *N. lateralis*, Say.

Rare in 3 fathoms, Toronto Bay.

2. *Nephelis*, sp.

An exceedingly remarkable form, apparently undescribed. The body is much flattened, and the width is nearly as great as the length when the animal is at rest. Length $\frac{1}{2}$ inch in extension, $\frac{1}{4}$ inch or less in contraction. Colour sometimes dark greenish brown or nearly black, sometimes light brown, with innumerable black points and numerous yellow spots, which are especially abundant at the margins. A double black dorsal line. The habits of this little leech are very remarkable. The adult leech usually places itself with its entire ventral surface closely appressed to some foreign body, such as a stone or dead shell, to which it adheres like a limpet or small *Chiton*. When forcibly detached or irritated it rolls up like a hedgehog or like the Myriopods of the genus *Glomeris*. The objects served by these peculiar habits become obvious when it is seen that almost every individual carries attached to the ventral surface of the body a large number (generally from twenty to thirty) of young leeches. The young are attached to the ventral surface of the parent posteriorly in a close cluster, which is surrounded on all sides by a vacant space; they adhere to the adult by their posterior suckers, which are separated from the body by a very distinct constriction. The young leeches are about $\frac{1}{25}$ of an inch in length, in colour light yellow or reddish, and semitransparent. The stomach is very conspicuous, and fills the greater part of the body; but no other internal organs could be detected. This extraordinary habit of carrying the young has been noticed by Verrill in a species of

Clepsine; but, so far as I am aware, attention has not been otherwise drawn to it (American Journ. Science and Arts, vol. iii. Feb. 1872). I have also observed it in a species of *Clepsine* from Lake Ontario, and shall describe it more fully upon a future occasion.

Common in from 1 to 3 fathoms.

3. *Clepsine*, sp.

A small leech, about ¾ inch in length in extension. The body flattened, with broad, transparent margins exhibiting numerous lateral papillæ. Back and belly, with exception of the transparent borders above alluded to, of a dirty greenish brown. The anterior end of the body is attenuated; the posterior extremity wide and flattened out; and when irritated, it has the habit of rolling up into a ball. This species, also, carries its young attached to the posterior portion of its ventral surface, in a small rounded bunch.

Common in from 1 to 3 fathoms.

4. *Clepsine* (?).

A small undetermined leech, of a worm-like shape and a red colour. Length when contracted about ½ inch, in extension about 1 inch. Instead of remaining quietly attached to some foreign body, like the preceding species, this leech swims actively through the water by a serpentine bending of the body.

Rare in 3 fathoms.

5. *Sænuris*, sp.

A large Oligochætous Annelide, about 2 inches in length, of a red colour, with an iridescent blue intestinal streak.

A single individual was obtained in 3 fathoms, on a sandy bottom.

6. *Sænuris* or *Chirodrillus*, sp.

A small and very slender form, varying in length from ¼ inch up to 1 inch, and of a red colour. These minute Annelides occurred in extraordinary numbers at all depths of the lake from 3 up to 45 fathoms; but they were much more abundant at the smaller than at the greater depths. They were uniformly found wherever the bottom consisted of a fine tenacious clayey mud.

CRUSTACEA.

7. *Gammarus*, sp.

A small freshwater shrimp, varying in length from ⅛ to ¼ inch, and of a greenish-brown colour during life, with a dark green intestinal tract. The antennæ and antennules are about half the length of the body, and nearly equal. Numerous examples of this pretty little species occurred amongst Charas and other water-weeds, in from 1 to 3 fathoms.

8. *Gammarus*, sp.

A minute form, not uncommon in shallow water in the ponds at the "island."

9. *Crangonyx* (?), sp.

A small Amphipod, as yet unexamined, which may perhaps belong to this genus.

Common in from 10 to 15 fathoms, amongst branches of *Cladophora*, upon a muddy bottom.

10. *Cypris* (?), sp.

A small Ostracode Crustacean, as yet undetermined, which occurred plentifully, along with the preceding, amongst *Cladophora* at depths of from 10 to 15 fathoms.

11. *Pontoporeia affinis* (Lindström).

Small Amphipods, varying in length from $\frac{1}{10}$ up to $\frac{1}{4}$ inch, of nearly uniform flesh-colour. They are referable to the genus *Pontoporeia*; and though they have not yet been satisfactorily examined, I have little doubt as to their being identical with the *Pontoporeia affinis* of the Swedish lakes and of Lake Superior.

They occur in great plenty in from 30 to 45 fathoms; but none were found in depths less than this, though they are found in Lake Superior in all dredgings, from the shallowest to the deepest. They were uniformly found inhabiting a muddy bottom; and they died very shortly after they were brought to the surface.

ARACHNIDA.

12. *Limnochares*, sp.

A fine species of this genus was extremely abundant in shallow water and in the ponds at the "island."

13. *Hydrachna*, sp.

A small water-mite of this genus occurred abundantly in Toronto Bay in from 1 to 2 fathoms.

INSECTA.

14. *Chironomus* or *Corethra*, sp.

The larvæ of a species of Dipteron belonging to one of the above genera occurred in great abundance in all the dredgings in which a muddy bottom was found in depths of from 2 to 20 fathoms, but more abundantly in the smaller depths. The colour varied in different examples from deep blood-red to pink or greenish; and their semitransparency rendered them very beautiful under the microscope.

15. *Ephemeridæ.*

Larvæ of Ephemerids were found rarely in shallow water to a depth of 2 fathoms.

MOLLUSCA.

16. *Planorbis trivolvis*, Say.

Very common in shallow water, but not extending beyond a depth of 3 fathoms.

17. *Planorbis parvus*, Say.

Very common in shallow water, but not extending beyond a depth of 1 fathom.

18. *Valvata tricarinata* (?).

A small species of *Valvata*, apparently referable to the above, occurred abundantly in from 2 to 3 fathoms, ranging, though in much diminished numbers, into depths of from 5 to 8 fathoms.

19. *Paludina*, sp.

A large form, nearly allied to *P. decisa*, Say (perhaps *P. impura*). This species occurred in a living state and in all stages of growth in from 2 to 3 fathoms on a sandy bottom.

20. *Paludina* (*Amnicola*), sp.

This is a very minute form which occurred in great plenty, crawling over the stems of *Chara* or *Anacharis* in from 1 to 3 fathoms.

21. *Limnæa jugularis*, Say (= *L. stagnalis?*).

A large species, occurring in great plenty in shallow water at Toronto Island. It is very nearly allied to *L. stagnalis*, but it may perhaps be distinct.

22. *Limnæa*, sp.

A smaller and more elongated form, nearly allied to *L. columella*, Say.

Rare in from 1 to 2 fathoms.

23. *Physa heterostropha*, Say.

Very common in shallow water at the "island."

24. *Physa*, sp.

A smaller form, rare in from 1 to 3 fathoms.

25. *Melania*, sp.

A form nearly allied to, if not identical with, the *M. depygis* of Say (=*M. niagarensis*, Lea?).

Common in from 2 to 3 fathoms in Toronto Bay.

26. *Cyclas similis*, Say.

Common in from 1 to 3 fathoms.

27. *Pisidium abditum*, Haldeman.

Common in from 2 to 5 fathoms.

28. *Unio crassidens*, Lam.

Common, both in the living and dead state, in from 1 to 3 fathoms in Toronto Bay.

29. *Unio*, sp.

A large ventricose form, common at the same depths and in the same locality as the preceding.

VERTEBRATA.

30. *Pimelodus catus* (=*P. atrarius*).

The young of this species, not more than 1 inch to 1¼ inch in length, occurred abundantly in the pools in the vicinity of the "island."

31. *Pomotis vulgaris*.

The young of the sunfish or northern *Pomotis* of Richardson occurred not uncommonly in shallow water at the "island."

32. *Perca flavescens*, Cuv.

The American yellow perch.

Common throughout Toronto Bay.

33. *Leuciscus*.

Two individuals of a small species of this genus were brought up by the dredge in Toronto Bay from a depth of about 2 fathoms.

GENERAL OBSERVATIONS.

In a mere preliminary report there are but a few general considerations which require notice. Upon the whole the results obtained in these dredgings in Lake Ontario agree very fairly with those obtained in Lake Superior; and there is a general conformity in the phenomena observed. The fauna of Lake Superior, however, so far as deep water is concerned, is decidedly richer than that of Lake Ontario; whilst some of the more remarkable forms discovered in the former appear to be altogether absent in the latter. This is especially noticeable as regards the singular Stomapod Crustacean *Mysis relicta*, which was found in great plenty in Lake Superior at all depths up to 148 fathoms, but which was not detected at all in Lake Ontario.

As might have been expected upon *à priori* grounds, the fauna of Lake Ontario is not extensive, though some forms occur in great profusion. The shallow-water fauna is very rich in individuals, and the number of species is quite considerable for fresh water. No doubt, also, the list might be much increased by a careful examination and by a more extended investigation than it was in my power to carry out. Beyond 8 or 10 fathoms the fauna becomes very scanty; and when we reach depths of 20 fathoms and upwards, the list becomes reduced to some small Annelides and Amphipod Crustaceans. The nature of the bottom, also, at great depths is exceedingly unfavourable to animal life, consisting almost everywhere of a fine clayey mud, the temperature of which is very low.

The most interesting forms of life discovered were the Annelides and Crustaceans. The Annelides are very abundant and varied, the two orders of the *Hirudinea* and *Oligochæta* being both represented, and the former presenting some species of peculiar interest. Of the Crustacea the most interesting is the little Amphipod which occurs in such numbers in depths of from 30 to 45 fathoms, and which appears to be identical with the *Pontoporeia affinis* of the Swedish lakes. This species and the Stomapod *Mysis relicta*, Lovén, are found in Lakes Wetter and Wener in Sweden; and it is well known that their occurrence in this locality, along with other species of marine genera, led to the belief that these lakes had been formerly part of the sea, from which they had been cut off by geological changes. On this theory these Crustaceans are the survivors of the original marine fauna of the area, which had been able to bear up under the gradual changes by which the formerly existing sea was converted into fresh water. The occurrence, therefore, of these same forms of *Pontoporeia* and *Mysis* in Lake Superior and of the former of them in Lake Ontario is an extremely interesting fact, whether Lovén's theory is to be accepted or not. It may be mentioned also that there are no insuperable geological difficulties which would prevent the application of this theory to the great lakes of North America. It is a singular fact, however, that whilst both these Crustaceans have been discovered in Lake Superior and also in Lake Michigan, only one of them has been found in Lake Ontario, the *Mysis* seeming to be wholly wanting.

XLIII.—*On the Structure of the Echinoidea.* By S. Lovén*.

[Plate XIV.]

Besides the well-known external organs, ocelli, spines, pedicellariæ, the clavulæ of the fasciole, tentacles, and branchiæ, the recent Echinoidea possess another kind of organs which have hitherto been overlooked, although they occur so generally that we seek them in vain only in *Cidaris*. These are very small, button-like bodies, spheroidal, ellipsoidal, or somewhat irregular balls, 0·11–0·375 millim. in their greatest diameter, furnished with a short stalk, which is movably attached to a small, slightly projecting tubercle. They may not unsuitably be named *sphæridia*. They are hyaline, shining, hard, solid, and clothed with connective tissue rich in pigment, with epithelium and a ciliated cuticle. Their pedicel has the reticulated texture typical of the Echinoidea, which spreads more or less distinctly and continuously around its starting-point. In the direction of the axis of the ball we not unfrequently see a tube which opens in its upper pole, and is either simple or branched in a more or less regular manner. A great many of the balls have on their surface small elevations, tubercles, or spines—and many also depressions, which are sometimes shallow, but sometimes sink deeply in, towards the axis, in a conical form. But the greater part of the mass of the ball is formed of very numerous and very thin concentric layers; and there are some which do not present any thing but these. Their solid contents are dissolved by a weak acid, so that only the epithelium remains.

The sphæridia belong exclusively to the ambulacra (radii); and in all the genera which possess them they are never wanting on the peristomial plates, but differ in number and distribution in a direction from the mouth. They always occupy a definite position. In the Spatangidæ they stand, generally uncovered, one, two, or more in a little group, by the base of the tentacular cirri of the buccal area, near the side turned towards the median suture of the ambulacra, decreasing thence the further from the mouth, especially on the bivium,—not unfrequently four, three, or two upon each of the first plates, only one upon each of the immediately following ordinary plates, in *Plagionotus*, *Brissus*, *Schizaster*, and *Mæra* (*Gualteria*?), more numerous on the bivium, in depressions, or like rows of beads in narrow, elongated, well-defined furrows; but in *Lovenia* the segregated sphæridia are concealed under domes, which have a small, narrow, transverse opening at their apex.

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A covering of this kind, which is an exception among the Spantangidæ, is the rule in the Cassidulidæ and Clypeastridæ. *Rhyncholampas caribæarum* (Lamk.), *Pygorrhynchus pacificus* (Agass.), and many others have on every plate of the first five pairs in each ambulacrum a sphæridium, which is gradually overgrown by the outer layer of the shell-substance, which finally leaves only a fine fissure open.

The Clypeastridæ exhibit two types. *Echinarachnius*, *Dendraster*, *Lobophora*, *Mellita*, *Encope*, *Rotula*, *Laganum*, *Scaphechinus*, and *Echinocyamus* have in each radius only a single sphæridium in common for both its peristomial plates, and most frequently, even in very young individuals, concealed in a crypt in the mass of the shell. Near the peristomial margin, which in the middle has a part somewhat projecting over the two large pores of the buccal tentacles, we see, behind this, a small, more or less distinctly halved elevation. On breaking this up we find a sphæridium with its pedicel attached to the inner surface of a rounded cavity towards the mouth, which is connected with the exterior either only by a fine canal, or, in *Rotula*, by means of a tolerably wide opening, which is in part covered by points projecting from its margin. In *Echinarachnius* this cavity is divided into two halves by a very thin, vertical membrane, which seems to issue from the edges of the plate united in the suture. It is otherwise with *Clypeaster* and *Arachnoides*; these have two sphæridia in each ambulacrum, one in each of its two peristomial plates. In both, the margins are destitute of the projecting part, and the two pores of the large tentacles are exposed, not, as in the preceding, in a surface falling abruptly towards the mouth, but in a more level and open surface which nowhere exhibits a sign of the presence of the sphæridium. In *Clypeaster* we can only perceive that, at a distance from the tentacular pores twice that of the latter from the margin, the large radial tubercles have between them a greater space than elsewhere, but not differing in the disposition of the small tubercles and pores. If we break through the outermost layer of the shell, we find in both plates a small cavity, and in this a sphæridium, placed as in the preceding. In the broad, perfectly smooth furrow which in *Arachnoides* occupies the middle of each ambulacrum, nothing indicates the position of the sphæridia; but we find them concealed in the shell at the same distance from the pores as in *Clypeaster*.

Echinoneus has, near the tentacular pores on the first and second plates, segregated globular sphæridia, which are seated uncovered in slight depressions. In this, as in much else, it resembles the regular Echinoidea.

In most of the latter the sphæridia are numerous and distributed alternately on both rows of plates of the ambulacra. *Echinus Flemingi*, *E. esculentus*, *Toxopneustes dröbachensis*, *Loxechinus albus*, *Tripneustes ventricosus*, *Echinometra lucunter*, and *Amblypneustes ovum* have their usually ellipsoidal sphæridia arranged near the sutures, with the long axes nearly parallel to the surface of the test. In *Temnopleurus*, *Salmacis*, and *Mespilia* their form is spheroidal, and they stand in the apertures of the deep cavities in the angles of the plates. In all these Echinidæ the row of sphæridia is separated on both sides from the tentacular pores by the series of large radiolar tubercles. In *Diadema*, on the contrary (*Astropyga*), the sphæridia are seated near the tentacular pores, and the radiolar series of tubercles is situated between them and the suture. *Echinocidaris* is quite different, as it has in each ambulacrum only a single sphæridium in a rounded notch in the suture quite close to the margin. In *Cidaris* sphæridia are not found.

These organs, which are so well and peculiarly protected in many genera (*Brissopsis lyrifera* seems to protect its uncovered sphæridia by binding together the neighbouring small radioli over them), cannot be any thing but a sensorial apparatus, probably destined for the perception of the changes which take place in the surrounding water and in the substances which this holds in solution or suspension, consequently an organ of taste. *Brissopsis lyrifera* holds them quite still for hours; then follows a half-circular movement around the point of attachment, which very soon ceases. The strong nervous stem which runs internally along the suture in each ambulacrum gives off alternate branches, one for each plate. Every such branch enters with the tentacular vessel into the pore of the plate, and passes through this out to the outer side of the test; in this way it may furnish both tentacles and sphæridia with nerves, although I have not succeeded in demonstrating this. It is easier, in *Brissopsis lyrifera*, especially in the bivium, to ascertain how the nerve, after issuing through the pore, loses itself on the outside of the calcareous layer, beneath the overlying connective tissue, in a great number of branches, which run through the anterior part of the plate in a radiating and diagonal direction in order to distribute themselves to the interradial radioli and other external parts attached to the plate. This branching is most distinctly seen on the third plate of the bivium situated near the sternum, which is freer from spines than the second.

The sphæridia make their appearance, seemingly, later than the spines and pedicellariæ in very young Spatangidæ (*Brissopsis lyrifera*, *Echinocardium ovatum*), first one alone in the single peristomial plate of the ambulacra, then one on the second plate, and so forth; all in accordance with the order which prevails in the disposition of the ambulacral plates throughout the whole class, and which, at least in all recent Echinoidea, may be expressed by a formula common to all. This order is as follows:—

If we hold a *Spatangus* of any species with the mouth turned upwards and the unpaired interradium backwards, and count the ten peristomial plates of the ambulacra going from left to right (that is to say, from the animal's right to its left side) round the buccal aperture of the test, marking, in each of the ambulacra I., II., III., IV., V., the plate we first come to with the letter *a*, and the second with *b*, we shall find that the plates I. *a*, II. *a*, III. *b*, IV. *a*, V. *b* are larger and bear two pores and two tentacles, whilst I. *b*, II. *b*, III. *a*, IV. *b*, and V. *a* are smaller and furnished with only one pore and one tentacle. Assuming that here each ambulacral plate has originally only one tentacle and one pore, the former series of plates should consequently, although no suture can be detected, be composite and binary, and the latter simple and primary, like all the other ambulacral plates. The *Cassidulidæ* behave in exactly the same manner; in the binary plates one of the pores is situated in the outer horn of the plate. That in the *Clypeastridæ* the peristomial plates of the ambulacra follow the same rule is seen from their unequal size—I. *a*, II. *a*, III. *b*, IV. *a*, and V. *b* being larger than I. *b*, II. *b*, III. *a*, IV. *b*, and V. *a*; and *Clypeaster rosaceus* has in the smaller plates one, and in the larger ones two tentacular pores, which differ by their size from the numerous pores for locomotor tentacles. If an *Echinoneus* be held in the above-mentioned position and counted in the same manner, the same arrangement is manifest. The peristomial plates I. *a*, II. *a*, III. *b*, IV. *a*, and V. *b* are larger and have two pores, a complete double pore and one which is marginal and half interrupted; I. *b*, II. *b*, III. *a*, IV. *b*, and V. *a*, on the contrary, are smaller and bear only one double pore.

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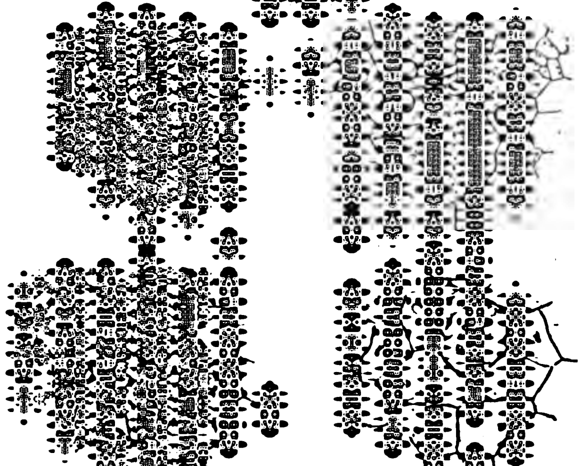

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[illegible] each other [illegible] ital plates. [illegible] the right [illegible] d when the [illegible] enters into it:—in some to a small extent, as in *Meoma ventricosa*; in others, *e. g. Brissopsis*, to a greater extent; and in some, *e. g. Schizaster fragilis* (Düb. & Kor.), so completely that the genital pore is absent, and with it the right anterior interradial genital gland. The next in order to disappear are the genital pore and gland of the left anterior genital plate; and when, as in *Abatus Philippii*, n., and *Palæostoma mirabile*, Gray, only two genital pores remain, these are situated in the lateral genital plates. An arrangement by which the madreporic plate extended backward separates from each other the eye-plates of the bivium, occurs among the *Spatangidæ* of the Eocene period, and not only in most of those which also belong to recent times, but also in some (*e. g. Prenaster*, *Macropneustes*) which had already made their appearance in the younger deposits of the Cretaceous formation. On the other hand the genera which essentially belong to the latter formation and attained in it their highest development, present throughout a different disposition of the genital and madreporic plates, at the same time that the latter does not reach the posterior interradium, but is separated from it by the eye-plates of the bivium, which meet and touch each other, as do also, in most, the lateral genital plates. Among the known living *Spatangidæ* only one has this character of antiquity, namely *Hemiaster expergitus*, n., which was discovered on the voyage of the Swedish corvette 'Josephine,' in the year 1869, by Smitt and Ljungman, near Josephina's bank, in 38° 7′ N. lat. and 9° 18′ W. long., at a depth of 550 fathoms on a clay bottom. The genus, which until then was regarded as having become extinct during the Miocene Tertiary period, and which attained its highest development during the Cretaceous period, is recognized by its rounded oval outline, which, with a length of 14 millims., has a breadth of 13 millims., by its posteriorly considerable height (10 millims.), by the position of the periproctium high up on the posterior surface, the single peripetalous broad fasciola, which forms an oval ring, the short, broad petala of the bivium half as long as the anterior ones, and, for still further distinction from *Abatus*, by the madreporic plate with which the anterior right genital plate is united, but which posteriorly does not reach the unpaired interradium, but is shut off from it by the two eye-plates of the bivium and the lateral genital plates. The individual is young, so that the four genital pores do not yet perforate the genital plates, and the madreporic plate has only a few pores; but the peristome is reniform, and the lobes prominent. The ambulacra are remarkably narrow where they pass under the fasciola. The test is extremely thin and brittle.

In the regular Echinoidea the anus opens in the circle formed by the genital and eye-plates perpendicularly above the mouth, and the corona, which is nowhere in contact with it, developes in like manner its ambulacra and interradia. The apparently regularly radiate form is originally disturbed by the madreporic apparatus, which perforates with its strainer one of the genital plates, all of which subsequently, during the early growth of the animal, become perforated by the efferent ducts of the genital glands. That even here the genital plate which contains the madreporic plate is the right anterior one, and that the ideal longitudinal axis of the body passes through the unpaired ambulacrum, as thereby indicated, is confirmed by the fact, that only by such a division between right and left does the same formula prevail for the plates of the peristomial margin in the regular as in the irregular forms. This is most distinctly observed in very young individuals, in which the primary plates may still be distinguished.

If a young *Toxopneustes dröbachensis* of from 3 to 6 millims. diameter be held with the mouth upwards, and the unpaired ambulacrum, determined as above, forwards, and the peristomial plates be gone through in the same sequence as was adopted in the examination of the irregular Echinoidea, we find not only that all the peristomial plates are composite (and may therefore be denominated large plates), but also that I. *a*, II. *a*, III. *b*, IV. *a*, V. *b* are all ternary; that is to say, every one of them consists of three still distinguishable primary plates; whilst I. *b*, II. *b*, III. *a*, IV. *b*, V. *a* are binary, formed of two primary plates. Consequently here also the peristomial plates of series I. *a*–V. *b* are larger than those of series I. *b*–V. *a*, and likewise bear more pores. In both series, the first primary plate has two pores, a complete double pore and one which is formed only by a notch in the very margin; and it may be supposed that this primary plate is a combination of two plates which were distinct in a still younger stage, the earliest formed of which, like all others, had a complete double pore, which afterwards, during growth, shifted to the margin and became reduced, its upper passage being closed and its lower one partly removed and thus converted into merely a notch of greater or less depth (see Plate XIV. figs. 1 & 2–8).

The primary ambulacral plates in the Latistellæ are in part entire, *i. e.* such as occupy the whole space between the interradium and the median suture of the ambulacrum, and in part halved, or such as extend from the interradium to about the middle of the entire ones, and terminate there in a more or less distinct point. The larger peristomial plates of the ambulacral series I. *a*–V. *b* generally consist, in very young individuals, of an entire adoral, a half intermediate, and an entire aboral primary plate; but sometimes all three are entire; in series I. *b*–V. *a* both primary plates are always entire.

The order which prevails in the ambulacra at the peristome recurs at the vertex. The corona of a young *Toxopneustes dröbachensis* of 4 millims. diameter, and with a stoma of 2·4 millims. is shown by the proportions given in the following table, which states for each large plate the number of its primary plates, of which the half ones are included in parentheses:—

Large plates:—		1	2	3	4	5	6	7
of series I. *a*–V. *b*.	I. *a* . .	1 (2) 3	1 (2) 3	1 (2, 3) 4	1 (2, 3, 4) 5	1 (2, 3, 4) 5	1 (2)	
	II. *a* . .	„	„	„	1 (2, 3) 4	„	1 (2, 3, 4)	
	III. *b*	„	„	„	1 (2, 3) 4	„	1 (2, 3, 4)	
	IV. *a*	„	„	1 (2, 3) 4	1 (2, 3) 4	„	1 (2, 3, 4)	
	V. *b* . .	„	„	1 (2, 3) 4	1 (2, 3, 4) 5	„	1 (2)	
of series I. *b*–V. *a*.	I. *b* . .	1, 2	1 (2) 3	1 (2, 3) 4	1 (2, 3) 4	1 (2, 3, 4) 5	1 (2, 3, 4) 5	0
	II. *b* . .	„	„	„	„	„	„	1
	III. *a*	„	„	„	„	„	„	1, 2
	IV. *b*	„	„	„	„	„	„	1
	V. *a* . .	„	„	„	„	„	„	1

It will be seen that the number of primary plates in each large plate increases from the peristome towards the vertex. In the rows of series I. *a*–V. *b* this increase is not quite regular, but somewhat unequal in the large plates 3 and 4, which may be an individual peculiarity; but the rows I. *a*–V. *b* of the bivium agree perfectly, even in the last plates, where the trivium also forms a group of similarly developed plates. In series I. *b*–V. *a*, however, the increase is the same throughout. In large plate 3 some individuals have 1 (2) 3.

In each row the peristomial plate 1 is the oldest; the other plates are younger in proportion as they are further from this; and the youngest is that which strikes upon the eye-plate of the vertex. The youngest plate has not the same ordinal number in the rows of both series. In the rows of series I. *a*–V. *b* it is the sixth, in those of series I. *b*–V. *a* the seventh, with the, perhaps, individual exception of I. *b*; so that this series, which in the peristome has one primary plate less than series I. *a*–V. *b*, has in its increasing end one or several more than this, inasmuch as not only is the large plate 6 completed, but even the large plate 7 is commenced.

Each large plate commences as follows:—Close to the aboral margin of a previously completed large plate the new first primary plate is formed, close to this the second, and so on.

All primary plates, even the half ones, are originally in their first foundation entire plates; that is to say, they reach from the interradium to the median suture of the ambulacrum. Subsequently, whilst the whole of the complex of primary plates which forms large plates increases in breadth, and even before it is completed by the last primary plates, the intermediate ones fall off in their growth; and whilst they retain their position in the boundary of the ambulacrum towards the interradium, their narrowed ends become more remote from the median suture of the former. The first formed of these intermediate plates is the smallest of all, the later ones become gradually larger; and thus it happens that whole groups of intermediate primary plates acquire forms of a triangular figure, the apex of which is formed near the middle of the large plate by the projecting end of the last alone. By all this it is also clear that these intermediate plates are not of later origin, neither secondary nor inserted, but that they are formed in ordinal sequence with the two outer entire plates. But the latter grow to a much greater degree, so that they directly touch each other where the intermediate plates cease, constitute the greatest part of the area of the large plate, and the whole of its margin towards the median suture.

The youngest large plates are distinctly longer, in the direction from the vertex towards the peristome, than broad; but in proportion as each large plate grows, and at the same time is removed from the vertex, it becomes broader in proportion to its length. The greatest periphery of the corona is always so placed that half the number of the plates and something more is ventral—that is to say, situated between it and the peristome, notwithstanding that the distance from it to the peristome is always less than to the vertical rings. Consequently during growth a compression from above downwards of the ventral plates takes place, which appears more strongly in proportion to their age, and, in combination with the movement which also takes place in each large plate, alters their form in a regular manner and at the same time changes the position of the pores. In the youngest individuals which have been examined, all the tentacular pores (with the exception of the very first interrupted one) are placed near the suture towards the interradium, and those which belong to the same large plate form together a curve with a slight, outwardly convex flexure. These are the primordial pore-arcs. But the tentacular pores begin very soon to move, in order to take up a different position, and finally form other secondary arcs, which remain the same during the animal's whole life, and are so characteristic that we derive from them the characters of the genera. What determines the issue of this removal is that the pores of the entire plates have, even in comparison with the size of the plates, a greater movement than those of the half plates. Every pore which belongs to an entire primary plate departs by degrees from its margin and approaches the middle. Within every large plate this movement is strongest in the first, adoral primary plate, and combined with a drawing downwards; in the last, aboral primary plate the same movement occurs, although in a less degree. In the intermediate half plates the shifting of the pores is nothing or almost imperceptible in the first, but more considerable and increasing in the following ones. Consequently, if a large plate is composed of a first entire primary plate, (1), three intermediate plates, (2, 3, 4), and again an entire plate, (5), the first pore moves far inwards nearly to the middle of the plate, the second retains its original position, the third has drawn itself a very little inwards, the fourth rather more, and the fifth still more. But it is a consequence of this unequal movement that the first pore no longer belongs to the original pore-arc, but has separated therefrom and entered and completed a new, secondary arc, the other members of which are constituted by the pores of the preceding large plate, with the exception of the first. The arcs of 3, 4, 5, 6, or 7 pores which characterize *Toxopneustes*, and in which the number of pores is dependent on the number of intermediate plates, are therefore always counted from and including the second pore in one large plate, to and including the first in the following plate. These alterations of the ambulacra are represented in Pl. XIV. figs. 2–8.

In the peristome, even in individuals of small size, all order seems to have disappeared in consequence of these shiftings. This, however, is only apparently the case. A careful examination shows that every thing arranges itself in accordance with the same law.

The peristomial plates of series I. *a*–V. *b* present the following alterations. The rudimentary double pore (1), which remains only as a notch in the very margin, moves gradually past the middle of the first plate and becomes still more inconsiderable; for whilst the corona grows near its vertical pole, some of its solid substance disappears in the margin of the peristome, where its calcaceous deposit is slowly absorbed, with the result that the pore-cup which was moving thither becomes, as it were, eaten away, and loses a greater or less portion of its wall. The perfect double pore (2) in the first primary plate (1, ɪ), which is an entire plate, moves, like this, from the suture towards the middle, and also approaches the margin, so that by degrees it loses a good deal of the wall round its lower aperture, after the upper one becomes filled up and blind. These two pores (1 and 2) form persistently a pair of themselves. The second primary plate (1, $_2$) is a half plate; its pore (3) removes very slightly from its original place, and commences the first distinct secondary arc, but, in consequence of the diminution and depression of the first primary plate, approaches the margin, where it also in its turn loses a part of its wall. The third and last primary plate (1, $_3$) of the first large plate is again an entire plate; and its pore (4) also moves inwards, and further than the preceding one. Pore *5*, which belongs to the first primary plate of the second large plate, is, as such, again the most movable, wanders far from the suture, and completes the first secondary arc of the three pores 3, 4, *5*. Pore 6, situated in the intermediate half plate 2, $_2$, remains in its place as the first of the second arc, again of three pores, of which the second, (7), in primary plate 2, $_3$, has moved inwards not inconsiderably, although not so much as the third (pore 8), which belongs to primary plate 3, $_1$. With pore 9, in primary plate 3, $_2$, again commences a third secondary arc of four pores, which move in accordance with the same law as the preceding ones—namely, 9, pl. 3, $_2$, 10, pl. 3, $_3$, 11, pl. 3, $_4$, and 12, pl. 4, $_1$. Whilst these movements have been going on, the large plates 1, 2, and 3 have also become more strongly compressed. In one individual (fig. 2) they constitute two thirds of the whole height of the corona, and the greatest periphery nearly coincides with the suture between 2 and 3; in fig. 3 they all lie below the line of the greatest periphery, occupy less than half the height of the corona, and their width is rather greater than their height. The first large plate (1), the peristomial plate, especially, is strongly compressed; its pores cease to grow; their upper tube is diminished or closed; pore 2 loses still more of its wall in the margin of the peristome; pore 3 gradually follows in the same direction; the radiolar tubercles disappear entirely or for the most part; and in the individual, fig. 6, the suture between the large plates 1 and 2 has disappeared, and they have coalesced to form a single binary large plate of the second order, 1 + 2, composed of six primary plates, which number cannot be distinguished; and the large radiolar tubercle it bears is that which originally belonged to large plate 2. In the individual, fig. 7, this double large plate 1 + 2 has become still more compressed; of pore 2 only half remains, and but little more of pore 3. The sutures of the primary plates now disappear still more within the large plate 3; and in the individual, fig. 8, even this has completely coalesced with 1 + 2 to form a single ternary plate of the third order, 1 + 2 + 3, composed of eleven primary plates, and consequently furnished with eleven pores, so placed that they may be counted as follows:—1, 2; 3, 4, 5; 6, 7, 8; 9, 10, 11, and, to complete the latter arc, 12 in the following large plate 4,—that is to say, in groups of 2, 3, 3, 4, &c. The form of this large composite plate has now become such that its breadth stands to its height about in the relation of 1 : 0·7. In the youngest specimen (fig. 2), in which the three plates are quite distinct, the breadth is to their length, taken together, as 1 : 2·25.

Within the first coronal plates which belong to series I. *b*–V. *a* corresponding changes take place, with only such differences as are due to the first large plate consisting only of two primary plates. Here, also, the plates 1, 2, and 3 coalesce, apparently almost earlier than in series I. *a*–V. *b*. The ternary plate of the third order finally produced by coalescence has then ten pores so arranged that they may be counted 1, 2; 3, 4; 5, 6, 7; 8, 9, 10, and, to complete the arc, 11 in the next large plate (4); consequently 2, 2, 3, 4, &c. It is by the second number that we recognize the peristomial plates of series I. *b*–V. *a*; it is there two, but three in series I. *a*–V. *b*; and this character is constant in the Latistellæ, which may be oriented by this means. The fourth arc, which here has four pores, has only three in occasional individuals; that is to say, the third large plate has only one intermediate primary plate. Some variability seems to prevail in this.

In the Echinidæ the tentacular pores are double pores. Within an oval space or cup bounded by a more or less elevated wall open two straight passages, through which aquiferous ducts pass to the tentacle. Their openings on the inside of the shell are considerably further apart than on the outside. These passages consequently traverse the thickness of the test in an oblique direction. If we compare the position of the outer apertures with that of the inner ones in the same plate of different ages and sizes, we find that the inner ones do not change their position so much as the outer ones; so that the passages which, in the younger specimens, take the shortest course from the inside to the outside, gradually draw away during growth in an oblique direction towards the middle, in the same proportion as the outer apertures shift their place. The movement which takes place in the substance of the plate is therefore not the same in its whole mass, and has, the nearer we go to the outside, a preponderant direction towards the median suture of the ambulacrum.

Thus, in *Toxopneustes dröbachensis*, do the ambulacra grow, with constant alterations in the plates and pores; but even in the largest individuals the different character of the two different series is recognized by the form and grouping of the above parts in the peristome. The numbers by which the arrangement of the pores can be indicated in that species (namely, in series I. *a*–V. *b*, 2, 3, 3, 4, &c.; and in series I. *b*–V. *a*, 2, 2, 3, 4) recurs not only in generically allied species, such as *Toxopneustes brevispinosus* and *T. lividus*, but also in *Loxechinus albus*, *Echinus esculentus*, *Lytechinus variegatus*, *Tripneustes ventricosus*, *Boletia heteropora*, *Amblypneustes ovum*, *Temnopleurus toreumaticus*, in fact throughout the Latistellæ, even in the *Echinometræ*. In the arrangement of the pores round the peristome the same numbers recur in the West-Indian *E. lucunter*, Linn., with striking distinctness. The madreporic plate is situated, as in all others, near the right anterior interradium; and the animal's antero-posterior does not coincide, as J. Müller thought he found, with the longest diameter of the oval test; but it is oblique, as L. Agassiz supposed; for the longitudinal diameter passes through ambulacrum I. and the corresponding interradium 3, and in its vertical plane are situated the lines of curvature for the flexure of the test. On the other hand *Heterocentrus* and *Colobocentrus* are symmetrical; in these, moreover, the short diameter of the test is its antero-posterior axis, in which direction also the peristome is elongated, with the posterior sinus deepest. This is the position accepted by J. Müller as the correct one in these genera; but the position which is thus given to the madreporic plate, he regarded as an exception from that which he regarded as the normal one both in *Echinus* and *Cidaris*, near the left posterior interradium. This is not the case. Except in the Clypeastridæ the connexion of the madreporic plate with the right anterior apical plate is constant in all Echinoidea. If its position is occasionally unknown, it is found in the Latistellæ by the formula of the arrangement of the pores in the peristomial plates, and by the antero-posterior axis of the same test, and its division into a trivium and a bivium.

The Latistellæ have ten free pore-plates in the buccal membrane. It might be asked whether these do not become very early detached from the corona, before the auricles are yet developed. Careful investigations under favourable conditions ought to settle this question. A small *Toxopneustes dröbachensis*, 2 millims. in diameter, has already the five pairs of large plates in the buccal membrane, each pair in front of an ambulacrum (fig. 9). Of these ten plates, those of series I. *a*–V. *b* are the larger, but destitute of tentacular pores; the other five, of series I. *b*–V. *a*, on the contrary, are smaller, and each furnished with its pore and its tentacle; that is to say, this latter series is here, as always, inferior in size, but superior in development to the former one. In a much earlier stage (fig. 10), when the young *Echinus*, 0·6 millim. in diameter, no longer shows any remains of its pluteus, but still does not present any indications either of mouth or anus, it moves, as we learn from J. Müller's investigations, by means of five large primordial tentacles furnished with sucking-disks, which issue, at equal distances apart, from inconsiderable depressions not far from the margin of the ventral surface of the lentiform body, which was turned towards the inside of the pluteus. Within these large tentacles is situated a circle of five pairs of calcareous reticulated disks, of a rounded, internally oblong form. Each disk has near its aboral end a large, evenly bounded, oval, outwardly pointed aperture, above which is placed one of the ten smaller tentacles (figs. 12 & 13). These five pairs of disks can hardly be any thing but the foundations of the first primary ambulacral plates, and the rather because, between the pairs nearer to the periphery, five smaller, nearly triangular plates come in, which then would be the first commencement of the interradia. Each of the five large primordial tentacles has its base in the line which separates each pair of the ten smaller and later ones, at the point from which the median suture of the ambulacrum will subsequently start. Can these five isolated tentacles have any thing in common with the tentacles of the buccal membrane, which also first make their appearance isolatedly? Krohn saw them become absorbed and disappear before the mouth opened, and the ten paired tentacles become the instruments of locomotion in their stead*.

[To be continued.]

XLIV.—*Notes on* Propithecus bicolor *and* Rhinoceros lasiotis.

By P. L. Sclater, M.A., Ph.D., F.R.S.

The Lemur described by Dr. Gray in the last Number of the 'Annals' (*anteà*, p. 206), as *Propithecus bicolor*, has been already named *Propithecus Edwardsi* by M. Alfred Grandidier (Compt. Rend. lxxii. p. 231, 27 Feb. 1871). M. Milne-Edwards, who has requested me to make known this correction, informs me that he has examined a marked skin of this animal received from Mr. E. Gerrard, jun., and has no doubt of the identity of the two species.

As regards the two Asiatic two-horned rhinoceroses in the Zoological Society's Gardens, when the first specimen arrived from Chittagong I referred it to *Rhinoceros sumatrensis*, that being the only species of this section then known to science.

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* Müller's Archiv, 1851, p. 351.

But when the second animal (obviously of a different species) reached us, I carefully examined the literature on the subject, and came to the conclusion (exactly contrary to that of Dr. Gray, *anteà*, p. 207) that the latter was the true *R. sumatrensis* and the former new to science. Under these circumstances, in a paper read before Section D at the British Association's Meeting at Brighton on the 16th of August last, I proposed to call the former *Rhinoceros lasiotis*[*]. Supposing even that the existing descriptions and figures of *Rhinoceros sumatrensis* are not sufficient to settle this question (which, however, is, in my opinion, by no means the case), the known localities from which the two animals were brought are of themselves strongly presumptive that my determination is correct. One was captured near Chittagong, in a district where no two-horned rhinoceros was previously known to occur; the other in Malacca, where the fauna is well known to be identical with that of the adjacent island of Sumatra. I may add that Mr. Blyth[†], who has paid special attention to the Asiatic rhinoceroses, and Dr. Dorner, who has examined not only the specimen in the Regent's Park, but also the similar animal in the Gardens of the Zoological Society of Hamburg, of which he is Secretary, are both of opinion that the Malaccan animal is the true *R. sumatrensis*; and I believe that any naturalist who has an opportunity of examining the two animals in the Zoological Society's Gardens will come to the same conclusion.

BIBLIOGRAPHICAL NOTICE.

Tortoises, Terrapins, and Turtles drawn from Life. By JAMES DE CARLE SOWERBY, F.L.S., and EDWARD LEAR. London, Paris, and Frankfort: Henry Sotheran, Joseph Baer and Co., 1872.

Dr. Gray, who edits this work, prefaces it by the following introduction:—

"This series of Plates was made under the superintendence of Mr. Thomas Bell, to illustrate his 'Monograph of the Testudinata,' a work in which the author intended to represent and describe not only all the known recent, but also fossil species. The publication of this extensive work was unfortunately interrupted (by the failure of the publisher) when only two-thirds of the plates that had been prepared (which in themselves formed but a limited portion of the intended work) were published.

"We are informed in the original Prospectus that 'The whole of the drawings are from the inimitable pencil of Mr. James Sowerby; and the author feels that he is only doing justice to that distinguished artist in natural objects when he states that in correctness of

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[*] See the 'Times' of August 19th, p. 5, where a notice of this paper is given; also 'Athenæum' of August 24th, p. 243.

[†] See 'Field,' August 24, 1872, letter signed "Z."

delineation, minute and elaborate execution, and taste in the general arrangement of the figures, nothing within the range of zoographical illustration has ever surpassed them. The Plates will be lithographed by Mr. Lear, coloured (so as to form the most perfect *facsimiles* of the drawings) by Mr. Bayfield. The joint talent of these excellent artists, exhibited in the illustrations of the Psittacidæ of the former gentleman, renders it unnecessary to say that the ability of the painter will be ably seconded by that of the lithographer and colourist.' Which I entirely indorse.

"The unsold stock and unpublished plates were purchased at Mr. Highley's sale by Mr. Sotheran, and the work has been in abeyance for many years.

"Mr. Bell has declined to furnish the text for the unpublished plates. In this difficulty Mr. Sotheran applied to me; and feeling that it was much to be regretted that such beautiful and accurate plates should be lost to science, and considering that such minutely accurate and detailed figures would not require to be accompanied by a description, I agreed to add a few lines of text to each Plate, containing first the original name that Mr. Bell placed upon them, then the name used in the Museum Catalogue of Tortoises, so as to bring the nomenclature to the level of our present knowledge of these animals, at the same time referring to a work in which the synonymy of the species is to be found. I have also added a few lines on the habits and manners of the species from works of authors who have had the opportunity of observing them in their native country.

"Many of the specimens figured and the rest of Mr. Bell's collection of reptiles are now to be found in the Anatomical and Zoological Museum at Cambridge."

The work contains 60 plates and represents 36 species; so that of many species there is a plate of the upper and underside, and of several, varieties of the same species. They are all from living specimens except *Emyda ceylonensis*, which is from a specimen preserved in spirit.

It is one of the most beautiful and accurate works that has appeared on Tortoises, and, one might almost say, on any known reptiles.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

June 20, 1872.—Sir James Paget, Bart., D.C.L., Vice-President, in the Chair.

"On the Echinidea of the 'Porcupine' Deep-sea Dredging-Expeditions." By Prof. Wyville Thomson, LL.D., D.Sc., F.R.S.

The deep-sea dredging-cruises of H.M. Ships 'Lightning' and 'Porcupine' during the summers of 1868, 1869, and 1870 in the North Atlantic, were comprehended within a belt 1500 miles in length by from 100 to 150 miles in width, extending from the Færöe

Islands along the northern and western coasts of Scotland and Ireland and the coasts of Portugal and Spain to the Strait of Gibraltar. In this area fifty-seven successful hauls of the dredge were made during the three summers in water exceeding 500 fathoms in depth, sixteen beyond 1000 fathoms, and two beyond 2000 fathoms.

Even at the latter extreme depth Echinodermata appeared to be abundant. At 2435 and at 2090 fathoms all the Echinoderm orders were represented—the Echinidea by a small variety of *Echinus norvegicus*, D. & K., and a young example of *Brissopsis lyrifera*, Forbes; the Asteridea by a species of the genus *Archaster*; the Ophiuridea by *Ophiocten sericeum*, Forbes, and *Ophiacantha spinulosa*, M. & T.; the Holothuridea by *Echinocucumis typica*, Sars; and the Crinoidea by a very remarkable new form of the Apiocrinidæ, which has been described under the name of *Bathycrinus gracilis*, Wy. T. From 2000 fathoms upwards the number of Echinoderms seems to increase rapidly; but this apparent increase may possibly be due to our wider knowledge of the fauna of the shallower water; at from 300 to 800 fathoms along the coast of Britain many species of all the orders are enormously abundant, so much so as to give a very marked character to the fauna of that special zone. Several of these species, such as *Cidaris papillata*, Leske, *Toxopneustes dröbachiensis*, Müller, *Echinus norvegicus*, D. & K., *Astropecten tenuispinus*, D. & K., *Archaster Parellii*, D. & K., *A. Andromeda*, M. & T., and *Euryale Linkii*, M. & T., have been long known to inhabit the deep water of the British area, and form part of a fauna which will be probably found to have a very wide lateral extension at temperatures whose minimum ranges from 0° C. to +2° C., a fauna which crops up, as it were, within the ordinary limits of observation in the seas of Scandinavia, and which has consequently been carefully studied by the Scandinavian naturalists.

Another group of species, including *Tripylus fragilis*, D. & K., *Ctenodiscus crispatus*, Retzius, *Pteraster militaris*, M. & T., *Amphiura abyssicola*, Sars, *Antedon Eschrichtii*, O. F. Müller, and several others, are members of the same fauna described from localities in the seas of Scandinavia and Greenland, but not hitherto known as British. A third section, consisting of a number of undescribed Echinideans, Asterideans, and Ophiurideans, may probably also belong to this fauna; while a fourth group, likewise undescribed, and including such forms as *Porocidaris*, *Phormosoma*, *Calveria*, *Pourtalesia*, *Neolampas*, *Zoroaster*, *Ophiomusium*, *Pentacrinus*, *Rhizocrinus*, and *Bathycrinus*, would rather appear to be referable to a special deep-sea fauna of which we as yet know only a few examples, and with whose conditions and extension we are unacquainted. This abyssal fauna is of great interest, inasmuch as nearly all the hitherto discovered forms referred to it show close relations to family types of Cretaceous or early Tertiary age, and hitherto supposed to be extinct.

Twenty-seven species of Echinidea were procured during the cruises of 1868, 1869, and 1870, off the coasts of Britain and Portugal, at depths varying from 100 to 2435 fathoms.

CIDARIDÆ.

Cidaris, Lamarck.

1. *C. papillata*, Leske.

Occurs in enormous numbers on gravel at depths of from 100 to 400 fathoms, from Færöe to Gibraltar, and small-sized examples are frequent down to 1000 fathoms. This is a variable species, and every possible link may be shown between the typical *C. papillata*, Leske, and *C. hystrix*, Lam. I have no hesitation, after examining many hundreds of specimens, in fusing the two forms into one species.

2. *C. affinis*, Stokes.

This is a pretty little species, and apparently distinct, although it is sometimes not easy to draw the line between it and small forms of *C. papillata*. It occurs abundantly in the Mediterranean, and locally off the coast of Portugal.

Porocidaris, Desor.

This genus was established by Desor chiefly on a character which I cannot regard as of great importance, and which is absent in the present species, a row of small holes surrounding the tubercles of the primary spines in the scrobicular areæ. From the description these holes seem to be nothing more than complete perforations, owing to imperfect calcification, in the position of the depressions which frequently occur in the scrobiculæ of the Cidaridæ for the insertion of the muscles of the spines. Along with this character, however, there were some others of greater value, a very remarkable paddle-like form of the spines surrounding the mouth, and a tendency to coalescence in the scrobicular areæ. These characters are well marked in the species described. This genus has hitherto only been found fossil—a few detached plates and some of the characteristic spines in the Nummulitic beds of Verona and Biarritz, and some spines referred to the genus, on account of their having the same singular form, in the Lower Oolite of Frick.

1. *P. purpurata*, n. sp.

Four examples from depths of from 500 to 600 fathoms off the Butt of the Lews.

ECHINOTHURIDÆ.

I think it due to the memory of the late Dr. S. P. Woodward to adopt as the type of this very distinct and remarkable family the genus *Echinothuria*, which he described with singular sagacity from one or two imperfect specimens from the White Chalk. The Echinothuridæ are regular urchins with depressed tests, rendered perfectly flexible by the whole of the plates, both ambulacral and interambulacral, being arranged in imbricating rows, the interambulacral plates overlapping one another from the apex to the mouth, and the ambulacral plates in the opposite direction. The margin of the peristome is entire, and the peristomial membrane is covered with imbricated scales, through which the ranges of double pores and ambulacral tubes are continued up to the edge of the mouth as in *Cidaris*. The ambulacral plates are strap-shaped, and the pores trigeminal; the two inner pairs of each arc pass through small accessory plates intercalated between the ambulacral plates, and the third pair, remote from the others, pass through the end of the ambulacral plate. The dental pyramid is broad and low, and the teeth are simply grooved as in *Cidaris*. The two divisions of the tooth-socket are not united by a closed arch; the ambulacral tube-feet on the oral surface are provided with suckers, while those on the apical surface are simple and conical.

Phormosoma, n. g.

Plates overlapping slightly and forming a continuous shell, the corona coming to a sharp edge at the periphery, and the upper surface of body differing greatly in character from the lower.

1. *P. placenta*, n. sp.

One example from 500 fathoms off the Butt of the Lews; several fragments from deep water in the Rockall Channel.

Calveria, n. g.

Plates overlapping greatly in the middle line of the ambulacral and interambulacral areæ. Plates narrow, and leaving fenestræ between them which are filled up with membrane. Character of the peristome with regard to the distribution of spines, the structure of the pore-areæ, &c. nearly uniform from the apex to the edge of the peristome.

1. *C. hystrix*, n. sp.

Fenestræ between the plates small. Colour a nearly uniform rich claret. One specimen in deep water off the Butt of the Lews.

2. *C. fenestrata*, n. sp.

Plates narrower than in the last species, and fenestræ wider. Of a pale grey colour, with bands of chocolate radiating from the apical pole. Two specimens from the coast of Portugal, and fragments in deep water off the south and west of Ireland.

ECHINIDÆ.

Echinus, Link.

1. *E. melo*, Lam.

One or two small specimens off the coast of Portugal.

2. *E. Flemingii*, Ball.

The large typical form of this species was met with in deep water off the Shetlands, but not abundantly.

3. *E. rarispina*, G. O. Sars.

4. *E. elegans*, D. & K.

5. *E. norvegicus*, D. & K.

The last three are critical species; and although the extreme forms are very dissimilar, in a large series there are so many intermediate links, that it is difficult to tell where the one begins and the other ends. It is possible that they ought to be regarded as varieties, and lumped together under Lamarck's name, *E. acutus.*

6. *E. microstoma*, n. sp.

Although I have great hesitation at present in proposing an addition to the genus *Echinus*, I feel compelled in the meantime to separate this very distinct form with a thin depressed test, a remarkably large periproct, and a small peristome with the edge markedly curved inwards and a uniform vivid red colour. *E. microstoma* is very abundant from 150 to 400 fathoms off the west coasts of Scotland and Ireland.

Sphærechinus, Desor.

1. *S. esculentus*, L., sp.

A marked variety, with a tall narrow test and white spines, in deep water.

Toxopneustes, Agassiz.

1. *T. dröbachiensis*, Müller.

Of this species it seems to me that *T. pictus*, Norman, and *T. pallidus*, G. O. Sars, can only be regarded as varieties. It is generally distributed at depths beyond 100 fathoms.

2. *T. brevispinosus*, Risso, sp.

Shallow water on the coast of Spain.

Psammechinus, Agassiz.

1. *P. miliaris*, Lam., sp.

2. *P. microtuberculatus*, Ag.

CASSIDULIDÆ.

Neolmapas, A. Agassiz.

This genus, with a nearly central pentagonal mouth and a tolerably distinct floscelle, with the anal opening at the bottom of a deep posterior groove excavated in a kind of projecting rostellum, with narrow ambulacral areæ and a small compact group of apical plates, must be referred to the Cassidulidæ; but it differs from all known genera of the family, living or extinct, in having no trace of a petaloid arrangement of the ambulacra, which are reduced on the apical surface of the test to a single pore penetrating each ambulacral plate, and thus forming a double row of alternating simple pores for each ambulacral area.

1. *N. rostellatus*, A. Ag.

I believe I am correct in referring to this species a single specimen dredged at the mouth of the English Channel. It is upwards of an inch in length, and therefore nearly double the size of the examples procured by Count Pourtales in depths of from 100 to 150 fathoms in the Strait of Florida.

CLYPEASTRIDÆ.

Echinocyamus, Van Phelsum.

1. *E. angulatus*, Leske.

Generally distributed, but not found living beyond 150 fathoms.

ANANCHYTIDÆ.

Pourtalesia, A. Agassiz.

According to the classification of Desor, which makes the "disjunct" arrangement of the ambulacra at the apex the test character of the Dysasteridæ, this genus should be referred to that group; for the apical disk is truly decomposed as in *Dysaster* and *Collyrites*, and not merely drawn out as in *Ananchytes*. From the arrangement and form of the pore-plates, however, and from the general appearance and habit of the animal, I am inclined to think with A. Agassiz that its affinities are more with such forms as *Infulaster*. *Pourtalesia* must be an aberrant form, in whatever group it may be placed. The mouth is at the bottom of a deep anterior groove, occupying the anterior ambulacral area. The arrangement of the trivium is nearly normal; but the bivial region is enormously prolonged backward into a long rostrum, on the upper surface of which, near its posterior extremity, the anus is situated in a pit partially covered by a projecting boss. The ambulacral pores are simple, one pore on each plate.

1. *P. Jeffreysi*, n. sp.

A single specimen of this very remarkable form was dredged in 640 fathoms to the north of the Shetlands. It is nearly allied to *P. miranda*, Pourtales, from the Strait of Florida, but differs in several details.

2. *P. phyale*, n. sp.

Two or three small specimens were dredged by Mr. Gwyn Jeffreys in the Rockall Channel. All the specimens are immature; but from the marked difference in form, and from some other characters, I believe them to be the young of a second species.

SPATANGIDÆ.

Brissopsis, Agassiz.

1. *B. lyrifera*, Forbes, sp.

Large specimens of this species are abundant at from 50 to 250 fathoms. Beyond the latter depth the specimens decrease in size, and at extreme depths only examples which have all the appearance of being very young are met with. These small delicate specimens were found at all depths, even down to 2090 fathoms.

Tripylus, Philippi.

1. *T. fragilis*, D. & K.

At from 400 to 500 fathoms between Scotland and Færöe. Hitherto known as Scandinavian.

Schizaster, Agassiz.

1. *S. canaliferus*, Val.

A single small specimen from the coast of Spain.

Amphidetus, Agassiz.

1. *A. ovatus*, Leske, sp.

Abundant at moderate depths.

Spatangus.

1. *S. purpureus*, O. F. Müller.

2. *S. Raschi*, Lovén.

This species is apparently gregarious, and is enormously abundant in patches here and there from the Færöes to the Strait of Gibraltar at depths of from 100 to 300 fathoms.

Of the twenty-seven species observed, six (namely *Echinus Flemingii*, *Sphærechinus esculentus*, *Psammechinus miliaris*, *Echinocyamus angulatus*, *Amphidetus ovatus*, and *Spatangus purpureus*) may be regarded as denizens of moderate depths in the "Celtic province," recent observations having merely shown that they have a somewhat greater range in depth than was previously supposed. Probably *Spatangus Raschi* may simply be an essentially deep-water form having its headquarters in the same region. Eight species (*Cidaris papillata*, *Echinus elegans*, *E. norvegicus*, *E. rarispina*, *E. microstoma*, *Toxopneustes dröbachiensis*, *Brissopsis lyrifera*, and *Tripylus fragilis*) are members of a fauna of intermediate depth; and all, with the doubtful exception of *Echinus microstoma*, have been observed in comparatively shallow water off the coasts of Scandinavia. Five species (*Cidaris affinis*, *Echinus melo*, *Toxopneustes brevispinosus*, *Psammechinus microtuberculatus*, and *Schizaster canaliferus*) are recognized members of the Lusitanian and Mediterranean faunæ, and seven (*Porocidaris purpurata*, *Phormosoma placenta*, *Calveria hystrix*, *C. fenestrata*, *Neolampas rostellatus*, *Pourtalesia Jeffreysi*, and *P. phyale*) are forms which have for the first time been brought to light during the late deep-sea dredging-operations, whether on this or on the other side of the Atlantic: there seems little doubt that these must be referred to the abyssal fauna, upon whose confines we are now only beginning to encroach. Three of the most remarkable generic forms, *Calveria*, *Neolampas*, and *Pourtalesia*, have been found by Alexander Agassiz among the results of the deep-dredging operations of Count Pourtales in the Strait of Florida, showing a wide lateral distribution; while even a deeper interest attaches to the fact that while one family type, the Echinothuridæ, has been hitherto known only in a fossil state, the entire group find nearer allies in the extinct faunas of the Chalk or of the earlier Tertiaries than in that of the present period.

MISCELLANEOUS.

On Thread-cells and Semen in Marine Sponges. By T. Eimer.

The researches which have been made during the last few years on sponges have led to the recognition of striking affinities between these animals and the Cœlenterata; nevertheless certain important differences in their organization and, in particular, in their histological structure even recently checked those who would have been most disposed to unite these two groups. M. Häckel said, in 1869:—"*The complete absence of the urticant organs in all the Sponges*, the constant presence of these same organs in all the Coralliaria, the Hydromedusæ, and the Ctenophora, constitute at present the *sole morphological character* which separates in a clear and definite manner the first of these classes from the three others. I have in consequence proposed already, in my monograph of the Monera, and, later still, in my 'Natürliche Schöpfungsgeschichte,' to unite these three last-named classes under the ancient name of Acalephes or Cnidæ (urticant animals)."

Notwithstanding the existence of this differential character, the idea that the sponges are only an inferior group of the Cœlenterata had gained ground. Thus M. Claus, in the second edition of his work on zoology, divides the subkingdom of the Cœlenterata into three classes—namely, the Spongiæ, Anthozoa, and Ctenophoræ. This grouping, which might appear rather rash, has just been confirmed in a striking manner by the discovery, due to M. Eimer, of urticant organs in the sponges. This naturalist has observed some organs of this nature in a certain number of siliceous sponges more or less related to the *Renieræ*.

In one species with remarkably viscous sarcode the urticant cells are found disseminated without any regular arrangement, but nevertheless frequently round the spicules, and most frequently surrounding throughout their whole extent the openings which give access to the afferent currents. They cover in particular abundance the cavity of the stomach; it seems, on the contrary, that they are wanting at the surface of the animal. Their form is an abbreviated oval, as in many of the Cœlenterata. Amongst those which are completely developed, numerous cells in the course of formation are found.

The second species which has presented urticant cells has oscula opening most frequently on papilliform eminences and conducting into canals lined with an extremely distinct membrane. It is this membrane which is furnished with urticant cells, in all degrees of development; they are more spherical and a little smaller than in the preceding species. Where the canals abut on the exterior surface of the body, they give place to ordinary cells.

A third species of sponges with urticant cells approaches very closely to the preceding, but differs from it by the absence of a cutaneous layer and in the nature of its spicules. The canals serving for the passage of the efferent currents are of the same width, and have the same arrangement as in the preceding, except that they are only lined with a very delicate membrane—so delicate, in fact, that it is often difficult even to prove its existence. This membrane bears the urticant cells and cells of formation in all degrees of development; but the urticant cells are very rare in the midst of the others. This species, which thus forms a passage between the sponges with urticant cells and those which are destitute of these organs, may be regarded as an arrest of development of the preceding.

The fourth form has no trace of a membrane lining the tubes which serve for the passage of the efferent currents. Its tissue, in most cases, is still more delicate than that of the preceding, from which it differs also in the spicules. It is ordinarily colourless; but yet individual specimens are found which have a slight reddish-blue colour; and from these we pass to others which are of a violet-blue. Among a great number of specimens of the bluish variety, M. Eimer has found some which were filled with urticant cells of a type totally different from that which he had observed in the other species, but bearing, like the others, very long threads. The urticant cells here not only cover the internal surface of the efferent tubes; they are diffused throughout the whole sponge, with their numerous cells of formation in all stages of development. It can be proved clearly by the latter that the essential part of the urticant cell (that is to say, the urticant organ) originates from the nucleus. The different individuals here do not present the same uniformity that is observed in the preceding species; they are seen to differ the one from the other in the numerical proportion of the cells in course of formation and those fully developed. In certain specimens we only find cells in course of formation; in others, as, for example, in the colourless variety, we no longer find even those.

M. Eimer remarks that, whilst Leuckart and Häckel think that it is through the calcareous sponges that the change from sponges to corals takes place, the discovery of the urticant cells reveals a remarkable affinity between the siliceous sponges and the Cœlenterata.

In addition to these details on the urticant organs, the author communicates the results of his observations on the nourishment of the sponges, which consists of little Crustacea, like that of certain polypes, and on the existence in these animals of incontestable zoosperms. This is not the first time the existence of zoosperms in the sponges has been noticed. Some bodies of that nature were found by Lieberkühn in the *Spongillæ*; and other naturalists have indicated their existence in marine sponges. But several of these observations were contested; it was supposed that, in certain cases at least, flagellated cells or Infusoria had been taken for zoosperms. M. Eimer figures perfectly characteristic zoosperms which he has observed in numerous gelatinous, siliceous, and calcareous sponges. Through the tissues will be found distributed spherical or oval balls, the surface of which appears granulated. A very strong magnifying-power shows us that these granules are caused by myriads of heads of zoosperms, which have their tails turned inward. When this ball has been broken, it may be seen that the head of the zoosperm bears a well-developed anterior prolongation or beak (*Schnabel*), which is darker than the other portions of the head. Except the greater length of this prolongation, the head has quite the same form as the zoosperms in man. The tail is of extreme thinness; and we can only perceive it with a very powerful objective, such as the immersion No. 10 of Hartnack; and even then it is impossible to follow it throughout its length. We can, however, see enough of it to convince us that in the full-grown zoosperms it is of an exceptional length; often we can count 150 μ. These zoosperms originate from cells with distinct nuclei; and M. Eimer believes he has noticed that the head is formed at the expense of the nucleus, whilst the filament originates from the protoplasm. He has always found with these zoosperms numerous ova; and for these reasons he considers the sponges to be hermaphrodites.

At the same time that M. Eimer was studying the sponges at

Capri, M. Häckel was also occupied with these animals on the shores of Dalmatia, and had likewise ascertained the existence of zoosperms and ova in the calcareous and siliceous sponges*. The results of his researches had even been published a little before the memoir of M. Eimer. The latter, however, thinks Häckel, like Huxley and Lieberkühn, had not under examination any completely developed zoosperms, but only slightly advanced forms of those elements. As, however, Häckel has observed a direct fecundation, M. Eimer hazards the supposition that there may be some sponges in which the zoosperms are arrested at one of the inferior stages of their development.—*Archiv für mikroskopische Anatomie*, vol. viii. Heft 2; *Bibl. Univ.* August 15, 1872, *Bull. Scient.* p. 350.

Investigations upon the Development of the Gregarinæ.

By E. van Beneden.

The investigations of M. E. van Beneden upon the *Gregarina gigantea* of the lobster confirm the observations of Lieberkühn upon the transformation of certain amœboid forms into *Gregarinæ*; only the phases are here somewhat different from those observed in the *Gregarinæ* of the earthworm. The author found, in the small intestine of the lobster, some small, finely granular, protoplasmic masses, destitute both of membrane and nucleus. These masses, which are continually changing their form, greatly resemble *Protamœba primitiva* or *P. agilis* of Häckel, from which they differ only by presenting fine molecular granulations even to the periphery, and by never emitting true pseudopodia. According to Häckel's nomenclature, these would be true gymnocytodes.

Side by side with these we find small protoplasmic globules, which differ from them only by having lost the faculty of moving and changing their form. They have no enveloping membrane any more than the former; but their spheroidal form is preserved by a peripheral layer of denser and less fluid protoplasm.

With these globular and motionless forms we find others perfectly similar to them, except that they have one or two prolongations which cannot be assimilated to pseudopodia, but rather to the movable stalk of the *Noctilucæ*. M. van Beneden names these *generative cytodes*, because it is these which directly give birth to the *Gregarinæ*. When there are two prolongations, these are inserted at but a little distance apart. One of these prolongations, which is shorter and more slender and with paler outlines than the other, and only contains very fine granules, is almost destitute of mobility. When brought against a hard body, it is seen to bend; and the bend thus produced persists for a very long time. The other prolongation is considerably longer and stouter, with stronger outlines and a more refractive protoplasm. Besides a very fine punctation, it contains opaque granules, which are very numerous at its slightly widened extremity. This process is endowed with an extreme mobility, which is manifested in two modes. It may swing about like the stalk of the *Noctilucæ*, or present an inflection which is propagated from the extremity towards the base, and which is followed by a sudden straightening of the whole arm. At the same time that this movement of straightening is made, a current carries the granular protoplasm from the centre of the cytode into the interior of the arm. This action repeated produces an elongation of the arm, which is accompanied by a narrowing of its basal portion and an accumulation of opaque granulations in its terminal part.

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* Jenaische Zeitschrift, vol. vi. Heft 4.

When the mobile arm has attained a certain length, it separates from the body of the cytode, and moves like a Nematode worm. We shall soon see what further transformations it undergoes.

After this arm has separated and acquired an independent existence, the other process follows the course of its development, and arrives at the same state as the former one; only for this purpose it requires the whole remainder of the body of the cytode.

If M. van Beneden has correctly coordinated the different phases which he has been able to observe in the intestine of the lobster, we must conclude that a single cytode gives origin successively to two prolongations, each destined to become developed into a *Gregarina*: one separates from the body of the cytode, the other absorbs the rest of that body.

These protoplasmic filaments, endowed with very active movements, the author designates by the name of *pseudofilariæ*; he supposes that it is their resemblance to young Nematode worms which has led certain authors to assume that the *Gregarinæ* are a phase in the evolution of the Nematoda.

These pseudofilariæ are thinned at one of their extremities, and slightly inflated at the opposite (cephalic) extremity, which is always strongly charged with refractive granules. After a certain period of activity their movements slacken; the length of the body gradually diminishes at the same time that its width increases, especially in the anterior part. Then all movement ceases, and the pseudofilaria remains motionless. Towards the middle of the body, there appears a dark circular spot, formed by a material more refractive than the protoplasm, and the limits of which become more and more distinct; this is the *nucleolus*. Around the nucleolus there appears a transparent zone without granulations, the limits of which are at first not very distinct, and which becomes the *nucleus* of the cell. The pseudofilaria shortens and becomes more or less oval; and an anterior projection or swelling, in which the refractive granules have a tendency to accumulate, begins to be distinguishable.

We have then before us a *Gregarina* which has no longer any important changes to undergo. It becomes elongated and acquires more and more the form of a tube slightly dilated in its anterior part. The posterior part becoming more elongated than the anterior, the nucleus finally settles at the extremity of the anterior third of the body. The refractive granules accumulated in the anterior terminal inflection form a mass separated from the granular protoplasm of the rest of the body by a sort of transverse septum, formed by a layer of transparent protoplasm. The external part of the protoplasm of the body, which at first formed a simple homogeneous and transparent layer without granules, becomes more and more distinctly bounded, and soon presents the form of a membrane with a double contour. The nucleus becomes regularly oval and also surrounds itself with a membrane.

By these changes and its increase in size the pseudofilaria finally acquires the definitive form of *Gregarina gigantea*, and a length of as much as 16 millims.

M. van Beneden follows this description of the development of the *Gregarina* with some very interesting general considerations upon the Monera and the Monerian phase of the *Gregarinæ*. According to him, if we admit that the substance of the Monera and cytodes is identical with the sarcode of the Rhizopoda and the protoplasm of cells, as regards *physical and vital properties*, we must regard it as different from those bodies from a chemical point of view, since it also contains the elements of the nuclear organs, which are differentiated from it in the cell. He consequently proposes the name of *plasson* for the *constitutive substance of the body of the Monera and cytodes*. Although recognizing with him that both in the ontogenic and in the phylogenic series we always, at the beginning, find this *plasson* before meeting with cell-formations, it seems to us that the necessity for this neologism has not yet made itself felt. Our knowledge with regard to the nuclear formations compared with protoplasm is too unsatisfactory to render it very urgent for us to distinguish these substances by names destined to indicate their chemical differences. Moreover, if we were to commence this course, we could not stop at the nomenclature proposed by M. van Beneden; it would be necessary to have :—a first name for the living substance which does not present either nucleolus, nucleus, or enveloping membrane; a second for that which has already abandoned the elements necessary for the formation of the nucleolus; a third for that from which have been separated the elements of a nucleolus and a nucleus, bodies which M. van Beneden regards as chemically distinct (p. 146); and a fourth for that which, besides these nuclear organs, has furnished the elements of an enveloping membrane. This list is still incomplete; we should have to add to it, among others, the protoplasm of the lepocytodes. It must be remarked, moreover, that the substance to which M. van Beneden wishes to give the name of *plasson*, on account of its chemical composition, is already a complex substance, even from a histological point of view, since the author recognizes in the interior of the transparent mass granules of two kinds, one kind being regarded by him as nutritive, combustible elements; he even explains, by the presence or absence of these granules, the different manner in which the movable and immovable arms of the *Gregarinæ* in the amœboid state behave.

The ontogenic development of the *Gregarinæ*, as M. van Beneden indicates, represents in an abridged form the phylogenic development of the cell. We have here an example of endogenous generation by the formation of the nucleus in the body of the pseudofilaria; but in the nuclear formation it is the nucleolus that first appears—a fact which it is important to notice, and which is the more striking because M. van Beneden has observed in the adult *G. gigantea* a successive disappearance and reappearance of the nucleoli.

To sum up, the *Gregarina* of the lobster would pass, in the course of its embryonic development, through the following phases:—the Monerian phase, the phase of the generative cytode, that of the pseudofilaria, that of the protoplast, that of the encysted *Gregarina*, and that of psorospermia.

There would therefore be in its evolution two phases during which reproduction would take place by division:—1, that which gives origin to the psorospermiæ after encystation; 2, that in which the generative cytode produces pseudofilariæ.—*Journal de Zoologie*, tome i. (1872) pp. 134–165; *Bibl. Univ., Arch. des Sci.* July 15, 1872, p. 256.

Diatoms in Hot Springs.

Dr. Blake has collected diatoms at a hot spring in Pueblo valley, Humboldt Co., Nevada, the temperature of which was 163° F. More than fifty different species were recognized by him; and they were found to be mostly identical with the species found in beds of infusorial earth in Utah and described by Ehrenberg, showing that the latter must have been accumulated in a hot lake, of about the same temperature. No other living species were found in the hot waters, excepting red algæ. The deposit was a large one, and in it there were concretions of silica. On making a thin section of one of these concretions, a pair of legs of a coleopterous insect were visible in the quartz; the greater part of the concretion was made up of petrified algæ.

In one of the hot springs at the California geysers, having a temperature of 198° F., he found two kinds of Conferva—one capillary, resembling *Hydrocrocis Bischoffii*, but larger; the other a filament, with globular enlargements at intervals. In another spring, the temperature 174° F., many Oscillariæ were found, which by the interlacement of their delicate fibres formed a semigelatinous mass, and also two diatoms. In the water of the creek of Geyser Cañon, 112° F., the algæ formed layers sometimes 3 inches thick, covering the bottom of the pools, and the same diatoms were found as in the 174° spring. The waters are acidulated by the presence of free sulphuric acid; and Dr. Blake suggests that this may account for the rarity of diatoms.—*Proc. Cal. Acad. Sci.* iv. pp. 183, 189, 193, 197.

On the Habits of Galeodes pallipes. By Prof. Cope.

Prof. Cope exhibited a specimen of a *Galeodes*, probably *G. pallipes* of Say, taken in the town of Denver, Colorado, by Dr. Gehrung. According to that gentleman, it was common in that place in houses, and was an enemy and destroyer of the *Cimex lectularius* (bed-bug). In captivity, it showed a preference for them as food, and crushed them in its short falces, preliminary to sucking their juices.—*Proc. Acad. Nat. Sci. Phil.* part iii. p. 295 (1872).

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XLV.—*On the Hydroid* Lar sabellarum, *Gosse, and its Reproduction.* By the Rev. THOMAS HINCKS, B.A., F.R.S.

[Plate XIX.]

MANY years have elapsed since Mr. Gosse described, in the 'Transactions of the Linnean Society,' a remarkable Hydroid, which he named *Lar sabellarum.* From that time to the present nothing more has been heard of it; and meanwhile it has been regarded with a kind of polite suspicion, and has held its place in our systematic works almost on sufferance. The unique oddity of its configuration and the grotesqueness of its attitude, as depicted by Mr. Gosse's pencil, are such as to justify some amount of incredulity, or at least to create a desire for further information. Allman, with a mixture of courtesy and scepticism, says of it, "we are almost tempted to regard it as an abnormal condition of some other form;" and in my 'History of the British Hydroid Zoophytes' I have assigned it a provisional place, in the hope that some new light might be thrown upon it by further observation. Under these circumstances it was with peculiar pleasure that I obtained during the past summer a fine colony of this half-mythical Hydroid in full maturity, and am thus enabled both to remove all doubts as to its true nature, and to complete the history of which Gosse has given us the first lines.

The *Lar* was dredged off the Capstone at Ilfracombe; and its polypites were distributed along the margin of a *Sabella*-tube, the very habitat in which Gosse's specimen occurred.

In the first place, I am able to vouch for the general accuracy of the figure which its discoverer has given us, and can affirm that, extraordinary as it *looks*, it does no more than justice to the original. It may, perhaps, be admitted that the skilful pencil of the artist has introduced the slightest touch of caricature; but it really only serves to bring out more strikingly the remarkable peculiarities of the creature.

The most marked characteristics of the genus *Lar* are to be found in the number and disposition of the tentacles, and in the curious head-like lobe in which the body of the polypite terminates above. The arms are reduced to two, which spring close together from the base of a prominent bilabiate proboscis endowed with great mobility; they are smooth, not muricated or roughened with clusters of thread-cells, and very extensile. These two tentacles face the mouth-bearing proboscis, and act with it in the capture of food; they are frequently jerked in the direction of the latter organ, which is furnished with two broad lips, and is itself capable of the freest and most energetic movement. The proboscis is marked off from the rest of the body by a well-defined constriction; near the top of it occurs a small space, which is thickly paved with thread-cells, forming a kind of boss a little below the summit (Pl. XIX. fig. 2, *a*). The polypites are fusiform, with a trace of brownish colour a little below the terminal lobe, perfectly sessile, and quite naked; they are very active and lively in their movements, and are constantly throwing the body and tentacles into the most fantastic attitudes. "The ludicrously close resemblance" which they bear to the human figure has already been noticed by Gosse, and will be apparent to any one on a reference to the Plate (Pl. XIX. fig. 1). In this genus, then, we have a most interesting modification of the structure that prevails amongst the Hydroida. Instead of a wreath of tentacles immediately surrounding the mouth, or several whorls distributed over the body, we have here two tentacles only, placed on one side and opposed to a highly developed movable proboscis, which acts energetically with them in the capture of prey, and compensates for the reduced number of the prehensile arms.

Gosse was not so fortunate as to meet with the reproductive zooids, and was therefore unable to give a satisfactory diagnosis of the genus; but the Ilfracombe specimen supplied this deficiency, and has shown that the gonosome, no less than the trophosome, is marked by very distinctive characters.

The fertile polypites of *Lar* (Pl. XIX. fig. 1, *ff*) are distributed along the creeping stolon, amongst the alimentary zooids, and bear a strong general resemblance to those of *Hydractinia*. They are slender, somewhat filiform bodies, destitute of tentacula, and terminated at the free extremity by a globular enlargement, in which many thread-cells are imbedded; they are generally inferior in size to the alimentary polypites. The reproductive buds are borne in clusters of three or four on the upper portion of the body, and when mature detach themselves as free medusiform zooids (*planoblasts**); they are destitute of an ectothecal covering (a character which they share with the gonozooids of *Clavatella*, *Corymorpha*, and *Cladonema*), and are therefore freely exposed to the surrounding water. In an early stage of development the buds are much elongated (Pl. XIX. fig. 1), and take on their hemispherical form as they approach maturity.

The planoblast (Pl. XIX. figs. 3, 4), at the time of its liberation, is almost hemispherical in form; the umbrella is perfectly colourless and destitute of thread-cells. The digestive sac or manubrium is very mutable in shape; normally it is subcylindrical, and somewhat swollen at the base, with a slightly lobate mouth. Six radiating canals traverse the umbrella, terminating on the margin in as many oval bulbs of a brownish colour, from which six smooth tentacles originate. Both ocelli and lithocysts are wanting; but halfway between every two tentacles a minute sac occurs on the margin of the umbrella, containing two or three glittering bodies, which appear to be thread-cells (Pl. XIX. fig. 6). The planoblast, when detached, bears with it a portion of the peduncle which had formed the bond of connexion between it and the parent stock; this survives as a somewhat conical process above the base of the manubrium (Pl. XIX. fig. 3, x), but is no doubt absorbed after a time.

Six is an unusual number for the radiating canals; amongst the British Hydroida it is met with only in *Clavatella* (which has also occasionally four) and in the genus *Willsia* of Forbes. The smooth tentacles (which closely resemble those of the polypite), the absence of the customary organs of sense, and the minute marginal sacs with thread-cells may also be noted as significant characters†.

There can be no doubt that the genus *Lar* must stand as the type of a distinct family amongst the Hydroida Athecata, which will present features as strongly marked as those of any group in the suborder. Indeed the important modification in the structure of the polypite has scarcely a parallel within the limits of the whole order. A question, however, arises as to the *name* of the family. *Laridæ* (which would be the natural designation, and which I have adopted in my 'History') has been appropriated by the ornithologists; and Allman proposes to substitute for it the compound *Hydrolaridæ*. I confess that I have serious doubts as to the expediency of this change. It seems to me that no practical inconvenience of any moment is likely to arise from the identity of the two family names, under the circumstances of the case; while there is a positive disadvantage in the adoption of a term which does not at once suggest the typical genus. The rules respecting zoological nomenclature have been framed with a view to general convenience, but are not to be inflexibly applied without regard to special circumstances. In the present case I should feel inclined to retain the name *Laridæ**.

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* Planoblast (wandering bud) is a happy and expressive term introduced by Allman to designate the free gonozooid.

† Allman considers it probable that the marginal sac is the origin of "what in the adult Medusa would become an interradial marginal tentacle" ('Monograph of the Gymnoblastic or Tubularian Hydroids,' part ii. p. 427).

The substance of this paper was communicated to Prof. Allman by letter, and is incorporated in the second part of his 'Monograph' just issued by the Ray Society.

The following is the amended diagnosis of the genus *Lar*, and of the only known species.

Subkingdom *CŒLENTERATA*.

Order HYDROIDA.

Suborder **ATHECATA**, Hincks.

Fam. **Laridæ**.

Genus Lar, Gosse.

Polypites fusiform, developed on a creeping filiform stolon clothed with a polypary; tentacles two, filiform, springing from one side of the base of a bilabiate proboscis, which is separated by a constriction from the rest of the body. Reproduction by means of medusiform planoblasts, which are borne on imperfectly developed polypites (blastostyles), terminating above in a spherical cluster of thread-cells.

Gonozooid: *umbrella* (at the time of liberation) subhemispherical; *manubrium* destitute of oral tentacles; *radiating canals* six; *marginal tentacles* six, springing from non-ocellated bulbs.

Lar sabellarum, Gosse.

Polypites about $\frac{1}{10}$ inch in height; a patch of thread-cells near the summit of the terminal lobe; mouth furnished with two broad lips; tentacula very extensile, smooth.

Gonozooids borne in clusters of three or four on the upper portion of the slender blastostyles: umbrella (at the time of liberation) colourless, destitute of thread-cells; manubrium subcylindrical, slightly swollen at the base, of a reddish-brown colour, not reaching to the orifice of the bell; tentacles smooth, springing from brown bulbs; a minute marginal sac, with thread-cells, halfway between every two tentacles.

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* Cases like the present, in which two family names are identical while the names of the typical genera differ (*Lar*, *Larus*), are likely seldom to occur.

Hab. Ilfracombe, off the Capstone, in shallow water, on the tube of a *Sabella*.

EXPLANATION OF PLATE XIX.

Fig. 1. A colony of *Lar sabellarum*, Gosse, highly magnified: *f f*, fertile polypites, laden with the reproductive buds.
Fig. 2. A single polypite (a portrait): *a*, collection of thread-cells.
Fig. 3. The medusiform gonozooid or planoblast: *x*, the remains of the peduncle by which it was attached.
Fig. 4. The same, with the tentacles extended.
Fig. 5. The same, as seen from above.
Fig. 6. The marginal sac, containing thread-cells.

XLVI.—*Notes on Coleoptera, with Descriptions of new Genera and Species.*—Part II. By Francis P. Pascoe, F.L.S. &c.

[Plate XV.]

List of Genera and Species.

TROGOSITIDÆ.

Neaspis (*n. g.*) villosa.
Peltis monilata.

CUPESIDÆ.

Cupes ocularis.

BRENTHIDÆ.

Taphroderinæ.

Taphroderes filiformis.
—— obtusus.

Ephebocerinæ.

Ionthocerus ophthalmicus.

Trachelizinæ.

Trachelizus Howittii.
Cordus semipunctatus.
Amorphocephalus sulcicollis.

Arrhenodinæ.

Prophthalmus sanguinalis.
—— planipennis.
Stratiorrhina (*n. g.*) xiphias, *Westw.*
Eupsalis promissus.

Belopherinæ.

Blysmia (*n. g.*) ruficollis.

Ceocephalinæ.

Ceocephalus internatus.
—— tenuitarsis.

Ithystenininæ.

Phocylides (*n. g.*) collaris.
—— ebeninus.
Achrionota (*n. g.*) bilineata.

Neaspis.

(Trogositidæ.)

Caput transversum; *clypeus* brevis, sutura clypeali fere obsoleta; *labrum* late transversum. *Mentum* parvum, subrotundatum; *labium* latum, subtransversum, apice anguste truncatum, barbatum; *maxillæ* lobis subæqualibus, interiore mutico. *Oculi* transversi, integri, grosse granulati. *Antennæ* 10-articulatæ, articulo basali unilateraliter valde ampliato, secundo et tertio obconicis, illo majore, quarto usque septimum gradatim brevioribus et latioribus, octavo, nono et decimo clavam magnam formantibus, sed duobus ultimis quasi conjunctis. *Prothorax* transversus, lateribus foliaceis, apice late emarginatus. *Elytra* oblonga, lateribus anguste explanato-marginatis. *Femora* compressa, *tibiæ* rectæ; *tarsi* lineares 4-articulati. *Coxæ* anticæ valde transversæ, quatuor postici approximati. *Prosternum* angustum. *Abdomen* segmentis longitudine fere æqualibus, liberis.

According to Lacordaire's arrangement of the Trogositidæ, the 10-jointed antennæ would place this genus in the Ægoliinæ; but in other respects it agrees better with *Leperina*, or, but for the inner unarmed lobe of the maxillæ, with *Peltis*. After a close examination of the tarsi, I can find no indication of an atrophied basal joint, as is usual in this family, although it is possible there may be one. The suture between the ninth and tenth joints of the club of the antennæ is so nearly obliterated that, except in certain lights, it does not seem to exist; as it is, I mention it with hesitation. In any case, the genus is especially differentiated in having seven joints only to the antennæ exclusive of the club; and it should, I think, form the type of a new subfamily (Neaspidinæ). I received three specimens of the species described below four or five years ago from my valued correspondent Dr. Howitt, of Melbourne, but without any precise locality. In appearance it is like *Peltis oblonga*, but much smaller and proportionally a little broader.

Neaspis villosa.

N. depressa, ovalis, supra fusca et subgriseo-villosa, marginibus prothoracis, labro, antennis, corpore infra pedibusque pallide ferrugineis; capite prothoraceque sat vage punctato; scutello semicirculari; elytris lateribus parallelis prothorace parum angustioribus, dorso striato-punctatis, subrugosis. Long. 2–2½ lin.

Hab. Australia.

Peltis monilata.

P. oblongo-ovata, fusca, opaca, marginibus prothoracis ferrugineis; capite prothoraceque reticulato-punctatis, punctis singulis in fundo tuberculo minuto instructis; antennis ferrugineis; lobo interiore maxillarum transverso, antice rotundato, inermi; scutello parvo; elytris rugoso-reticulato-punctatis, singulis lineis tribus elevatis munitis; corpore infra pedibusque piceis, confertim punctulatis; prosterno planato, dilatato, postice late truncato; acetabulis anticis occlusis; tibiis anticis apice spinoso-productis. Long. 4½ lin.

Hab. Australia.

In general appearance this species is somewhat between *Peltis oblonga* and *P. procera*; and, as in the latter, the inner lobe of the maxillæ differs from that of *Peltis* proper (*P. grossa*) in not running out and ending in a hook. The anterior cotyloid cavities, on the other hand, are closed in behind; and in this it differs from *P. procera*. It is this latter character which has induced Dr. Leconte to propose a new genus (*Nosodes**) for the reception of the American species (*serrata* and *silphides*); but then these species are said to have the internal maxillary lobe hooked. Hitherto, I believe, it has been taken for granted that this is the case in all the species; and Lacordaire even differentiates his tribe "Peltides" by this character. With regard to the anterior cotyloid cavities, rather too much stress has, it appears to me, been laid on them; at least I think it is as well to be cautious in separating generically nearly allied species by characters depending on them. Under an ordinary lens, and in a certain light, the lines on the elytra have a beaded appearance, which suggested the name.

Cupes ocularis.

C. griseo-brunnea; capite longitudinaliter profunde sulcato, supra oculos subbituberculato; oculis amplis; prothorace capite minore, transverso, dorso utrinque fortiter excavato, angulis anticis subacutis; scutello postice latiore, rotundato; elytris carinatis, inter carinulas biseriatim fortiter, sat confertim punctatis; corpore infra infuscato. Long. 5 lin.

Hab. Japan.

This is the second Asiatic species of a genus otherwise American, except two undescribed species from Borneo in my collection; the Chilian species (*C. Latreillei*) differs from the others in the antennæ having a large basal joint and in other characters. The species before us is remarkable for its large eyes.

Taphroderes filiformis.

T. angustissimus, nitide piceus, disperse villosus; elytris flavo trifasciatis; capite prothoraci latitudine fere æquali, subtilissime vage punctulato; rostro apice flavo; antennis ferrugineis; prothorace obsoleto impunctato, ante medium valde angusto; elytris prothorace angustioribus et sesquilongioribus, apicibus angulo exteriore productis, fascia flava ante, altera pone medium tertiaque apicali notatis; femoribus anticis ampliatis. Long. 3½ lin.

Hab. Amazons.

In the females of this genus the antennæ are longer and more slender, and the rostrum is not stouter at the base as in the males. The description of *T. brevipes*, Gyll., in Schönherr appears to have been made from the latter sex—and not from a female, as stated.

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* To *Nosodes* must be referred the European *P. dentata*. It is the type of *Calitys*, C. G. Thomson, a name of later date than *Nosodes*.

Taphroderes obtusus.

T. robustior, nitide piceus, lævigatus, capite quam prothorace multo angustiore, obsolete punctulato; rostro paulo arcuato; antennis piceis, articulis tertio usque decimum unilateraliter productis; prothorace elongato, pone medium ampliato, antice supra linea longitudinali impressa notato; elytris brevioribus, apice obtusis, maculis quatuor ferrugineis (2 ante, 2 pone medium) ornatis; corpore infra piceo-nigro; coxis anticis fulvis. Long. 4 lin.

Hab. Amazons.

At least twice as stout as the preceding, the apices of the elytra not produced, &c.

In reference to M. Lacordaire's note (Gen. vii. p. 410), I have reexamined my *Cyphagogus advena*; and although its shorter rostrum approaches it to *Zemioses*, as I have already remarked, in other respects (*i. e.* antennæ, legs, &c.) it is a true *Cyphagogus*. *Aprostoma*, Guér., which Lacordaire had not seen, but refers to the Taphroderinæ, is a Colydiid, afterwards named by Erichson *Mecedanum*.

Ionthocerus ophthalmicus. Pl. XV. fig. 4.

I. omnino nitide rufo-ferrugineus, apicibus articulorum antennarum nigris exceptis; rostro modice crasso, basi subcylindrico, antennis in medio insertis; prothorace lævi, dorso antice tenuiter, postice fortiter sulcato; elytris simpliciter striatis, striis tribus suturalibus tantum conspicuis, apicibus extus planato-productis; tarsis parce pilosis. Long. 3 lin.

Hab. Queensland (Rockhampton).

Lacordaire founded *Ionthocerus* on a species from Ceylon, from which the present differs in its uniform colour, thinner rostrum, and glossy elytra otherwise sculptured. My specimen, like Lacordaire's, appears to be a male. With *Ephebocerus*, Lac., it forms a subfamily remarkable for the long slender antennæ clothed with delicate hairs, and large eyes occupying the greater part of the head.

Trachelizus Howittii.

T. nitide fulvo-testaceus; capite prothoraceque lævigatis, remote punctatis; rostro paulo arcuato, haud gibboso, inter antennas sulco longitudinali impresso; oculis parvulis; antennis articulo primo vix incrassato, ultimo acuminato; sulco prothoracis ab apice ad basin extenso; elytris fortiter striatis, sutura valde elevata; corpore infra sparse punctulato; metasterno segmentisque duobus

basalibus abdominis longitudinaliter late excavatis; coxis anticis approximatis; femoribus subpedunculatis. Long. 2 lin.

Hab. Melbourne.

I have adopted M. Jekel's catalogue name for this little species, the only one, I believe, hitherto found in Australia.

Cordus semipunctatus. Pl. XV. fig. 7.

C. (♂) nitide ferrugineus, capite pone oculos cylindrico, subconstricto; rostro difformi, basi alte carinato, inter antennas excavato, apice dilatato; mandibulis productis; antennis validis, articulis secundo usque decimum transversis, cylindricis, perfoliatis, ultimo ovato-acuminato; prothorace oblongo, utrinque rotundato, basi apiceque æquali, antice subtiliter vage, postice gradatim magis confertim et fortiter punctato; scutello nullo; elytris subparallelis, late sulcato-punctatis, punctis haud approximatis, interstitiis acute carinulatis, apice obtuse rotundatis; pectore vage punctato; abdomine nitidissimo, impunctato; femoribus crassis, muticis; tibiis compressis, in medio sensim incrassatis, apice spina conica instructis; tarsis linearibus. Long. 8¼ lin.

Hab. Natal.

This species has the normal head of *Cordus* and the broad irregular rostrum of *Amorphocephalus*, and is therefore intermediate in these respects between the two genera; but as the former character apppears to be of the most importance, it is referred to *Cordus*; it may, however, be desirable eventually to separate it generically.

Amorphocephalus sulcicollis.

A. (♂) nitide ferrugineus; capite brevi, postice vix truncato, inter oculos verticeque profunde triangulariter excavato, fundo excavationis leviter sulcato; oculis ampliatis; rostro supra paulo arcuato, longitudinaliter fortiter excavato, basi utrinque oblique constricto et lobo ovali munito, infra cornu verticali armato; antennis articulis secundo usque octavum valde transversis, nono et decimo longioribus, perfoliatis, ultimo conico; prothorace oblongo, basi quam apice parum latiore, in medio fortiter canaliculato; elytris prothorace in medio vix latioribus, striatis, interstitiis convexis subtilissime sparse punctulatis; tibiis intus bisinuatis, apice spina conica instructis. Long. 5 lin.

Hab. West Australia.

The canaliculate prothorax is an exceptional character in the subfamily to which *Amorphocephalus* belongs; but it occurs in the genus *Trachelizus*, the representative of the group. I have two other specimens of *Amorphocephalus* from West Australia, one of which may possibly be the female of the above (see fig. 9, *a*, the head), the other (see fig. 9, *b*, the head) may be the female of *A. australis*, Lac., only that the latter is said to be from Moreton Bay; its prothorax is not canaliculate, but is rather closely and coarsely punctured.

Prophthalmus sanguinalis. Pl. XV. fig. 6.

P. validus, nitide piceo-rufus; ♂ rostro lævi, supra fortiter excavato, apicem versus late explanato; antennis articulis tertio usque octavum longiusculis, subæqualibus, ultimo duobus præcedentibus conjunctim parum longiore; capite prothoraceque impunctatis, opacis, supra nitidis, illo ab oculis gradatim paulo latiore, hoc in medio lineatim sulcato, apice sulcatim constricto; elytris longitudine prothoraci cum capite usque ad oculos æqualibus, sulcatis, sulcis primo et secundo a sutura impunctatis, interstitiis planatis, reliquis punctatis, interstitiis angustioribus, elevatis, singulo lineola basali alteraque apicali, et plagis duabus, una ante altera pone medium, sanguineis, decorato, apicibus paulo divergentibus, subtruncatis, corpore infra pedibusque nitidissimis, lævigatis; femoribus anticis validis, infra bidentatis. Long. 17 lin.

Hab. India.

Apparently near *P. potens*, Lac., but with broader sutural interstices and the others narrower, and having two large lateral blood-red patches on each elytron. Besides the difference generically, the female has a broader and more opaque prothorax, and has only one tooth on the anterior femora, and their trochanters not produced.

Prophthalmus planipennis. Pl. XV. fig. 5.

P. niger; capite rostroque lævibus, nitidis, parce irregulariter punctatis, ♂ hoc supra fortiter excavato, apicem versus paulo explanato; genis juguloque transversim plicatis; antennis articulis secundo usque sextum subturbinatis, cæteris parum gradatim crassioribus, ultimo anguste ovato; prothorace in medio nitido, impunctato, ad latera squamositate grisea induto, apice integro; elytris subnitidis, ad latera abrupte deflexis, dorso planatis, tenuiter sulcatis, interstitiis 1. et 2. latioribus, planatis, tertio basi, quarto pone medium, apice excepto, flavis, cum quinto angustis elevatis, cæteris magis depressis; corpore infra pedibusque nitidis; femoribus anticis subtus dente valido instructis. Fœmina latet. Long. 9 lin.

Hab. Celebes.

Remarkable for the flatness of its elytra; in other respects it is allied to *P. tridentatus*, Fab.

STRATIORRHINA.

(Brenthidæ.)

Ab *Estenorhino* differt *rostro* ante antennas serrato vel dentato, et *mandibulis* parvis, concretis.

The type of this genus is *Arrhenodes xiphias*, Westw.

(Cabinet of Oriental Entomology, p. 31, pl. xv. fig. 1), referred by Lacordaire, oddly enough, to his *Estenorhinus*, from which it essentially differs in the characters given above. M. Lacordaire mentions having seen two other allied species from Malacca.

Eupsalis promissus. Pl. XV. fig. 8.

E. nitide rufo-castaneus, elytris oblonge flavo guttatis; capite antice convexo; rostro inter antennas elevato, basi utrinque lobo oblongo retrorsum producto; antennis articulis quinque basalibus subobconicis, sexto usque decimum ovalibus, ultimo ovato-acuminato; prothorace sat anguste ovato, impunctato; elytris subtiliter striato-punctatis, stria suturali excepta, in certa luce lævigatis; femoribus anticis subtus dente acuto instructis, reliquis subtus ad apicem emarginatis. Long. 5–7 lin.

Hab. Batchian.

The female only differs in having the rostrum, beyond the insertion of the antennæ, slender and cylindrical; in the males the mandibles vary from being only slightly prominent to the normal condition, as shown in fig. 8. The lobe at the base of the rostrum on each side leaves a clear space between it and the cheek, or part just before the eye. The other three described species of *Eupsalis* are one North-American, extending so far north as Canada, and two African, including one from Madagascar; but I have another species from Old Calabar.

BLYSMIA.

(Brenthidæ.)

(♀) *Caput* transversum, postice truncatum, collum retractum; *rostrum* breviusculum, cylindricum, basi incrassatum, elevatum. *Oculi* rotundati, majusculi. *Antennæ* lineares, corpore longiores, articulis longitudinaliter strigosis. *Prothorax* breviter ovatus, supra haud sulcatus. *Elytra* breviuscula, parallela, apice late rotundata. *Pedes* breves, antici majores; *femora* modice crassa, mutica; *tibiæ* normales; *tarsi* articulo primo breviusculo. *Metasternum* et *abdomen* sat brevia.

The male is unknown, but probably differs principally in having a broader rostrum and the antennæ inserted more towards its middle. The genus in its aspect is quite different from the ordinary Brenthidæ; but its affinities are, I think, with *Belopherus*. The tarsi seem to be glabrous or only very slightly ciliated beneath; but my specimen having been gummed down, it is difficult to be exact. The abdomen, however, which is comparatively short, is nearly twice as long as the metasternum.

Blysmia ruficollis. Pl. XV. fig. 1.

B. nigra, opaca, prothorace (apice excepto) rufo, subtus nitide lutea; capite impunctato, supra postice subbilobo; rostro, apice excepto, rufo-testaceo, subnitido; antennis nigrescentibus, parce setosulis, articulis tribus basalibus brevioribus, secundo multo breviore; prothorace impunctato, apice quam basi angustiore et nitide nigro; elytris prothorace haud latioribus, supra subdepressis, striatim fortiter foveatis, foveis quadratis; pedibus nigris, nitidis. Long. 3 lin.

Hab. Batchian.

Ceocephalus internatus.

C. rufo-ferrugineus, nitidus, subtus, prothorace femoribusque castaneo-rufis; ♂ rostro prothorace breviore, basi canaliculato, apicem versus gradatim dilatato; antennis articulis secundo usque decimum transversis, perfoliatis, tribus ultimis parum crassioribus; prothorace elytris paulo latiore, supra profunde sulcato, apice nigromarginato; elytris fere parallelis, apice paulo explanatis, late rotundatis, striato-punctatis, stria juxta suturam profunda, impunctata, postice in strias duas divisa; femoribus apice nigris, subtus obsolete dentatis. Long. 7–9 lin.

Hab. Queensland.

The female has a more slender rostrum, with the antennæ inserted nearer the base.

Ceocephalus tenuitarsis.

C. nitide castaneus; rostro prothorace multo breviore, basi canaliculato, versus apicem gradatim dilatato; antennis articulis secundo usque decimum transversim moniliformibus, tribus ultimis majoribus, clavam quasi formantibus; prothorace elytris vix latiore, impunctato, profunde sulcato; elytris fere parallelis, brevioribus, sulcato-foveatis, foveis approximatis; pedibus sat vage setosulis; tarsis angustis. Long. 6 lin.

Hab. Sydney.

In this and the preceding species the constriction of the neck begins a little behind the eyes; the head, therefore, is more abruptly limited than in the African members of the genus.

PHOCYLIDES.

(Brenthidæ.)

A *Prodectore* differt *tibiis* intermediis et posticis brevibus compressis, *tarsis* articulo basali brevi, obconico; a *Diuro antennis* articulis secundo tertioque fere æqualibus, *prothorace* longitudinaliter sulcato, et *femoribus* clavatis, basi pedunculatis.

The antennæ also are shorter and stouter than in either *Prodector* or *Diurus*; and the elytra at the apex are drawn out

in two parallel and contiguous tails, nearly of the same width as the rest of the elytra. *Brenthus ruficollis*, Guér., a species not noticed by Lacordaire, also belongs to this genus.

Phocylides collaris. Pl. XV. fig. 2.

P. niger, subnitidus, prothoracis apice basique sordide rufis; ♂ capite postice fortiter impresso; rostro in medio lineatim canaliculato; prothorace subtilissime punctulato, utrinque pone medium paulo incurvato, apice transversim tri- vel quadriimpresso, pone apicem profunde longitudinaliter sulcato; elytris postice sensim angustioribus, prope suturam bistriatis, cauda modice elongata; corpore infra nitide piceo; ♀ rostro basi sola canaliculato; elytris singulis apice extus in processum mamilliformem rufum productis. Long. ♂ 19 lin., ♀ 11 lin.

Hab. Batchian.

Phocylides ebeninus.

P. niger, capite rostroque nitidis, minus elongatis, illo postice paulo angustiore, hoc late sed minus profunde canaliculato; prothorace opaco, subtiliter parce punctulato, pone medium utrinque modice rotundato; elytris parallelis, prope suturam bistriatis, apice singulorum in caudam multo breviorem producto; corpore infra pedibusque nitidis. Long. 9 lin.

Hab. Amboyna.

ACHRIONOTA.

(Brenthidæ.)

Ab *Ithysteno* differt *elytris* singulatim stria unica suturali instructis; et *femoribus* linearibus; a *Diuro rostro* apice dilatato (vel apice obcuneiformi).

In *Ithystenus* there are two striæ, and the femora are strongly pedunculate; the head, antennæ, rostrum, and legs are also shorter than in any of its species. The single character that distinguishes *Achrionota* from *Diurus* is too important to allow of the species described below being referred to that genus. The female is unknown.

Achrionota bilineata. Pl. XV. fig. 3.

A. fusca, opaca, parte apicali rostri pedibusque rufo-ferrugineis, punctis raris squamositate ochracea repletis ubique tecta; capite linea longitudinali tenuiter impresso; rostro capite plus duplo longiore, supra ante antennas fortiter sulcato, pone antennas tenuiter bisulcato; antennis griseo-pubescentibus, setulis vagis nigris adspersis; prothorace dorso punctis bivittatim notato; elytris subsulcatis, remote punctatis, singulis linea ochracea e squamulis condensatis formata, ornatis, apicibus angulo exteriore in caudam contortam linearem productis; corpore infra pedibusque punctis minoribus conspersis. Long. 8–10 lin.

Hab. Sarawak.

EXPLANATION OF PLATE XV.

Fig. 1. *Blysmia ruficollis* (♀).
Fig. 2. *Phocylides collaris* (♂).
Fig. 3. *Achrionota bilineata* (♂).
Fig. 4. *Ionthocerus ophthalmicus* (♂); 4 *a*, right fore leg. The hairs on the antennæ are too delicate to be represented in a figure of this size.
Fig. 5. *Prophthalmus planipennis* (♂).
Fig. 6. —— *sanguinalis* (♂).
Fig. 7. *Cordus semipunctatus* (♂); 7*a*, head and antennæ, side view.
Fig. 8. *Eupsalis promissus* (♂). The antennæ are not sufficiently accurate as regards the last five joints.
Fig. 9 *a*. Head of *Amorphocephalus*, sp. nov. (♀), (prothorax canaliculate); 9 *b*, head of *Amorphocephalus*, sp. nov. (♀), (prothorax not canaliculate, allied to *A. australis*, Lac.).
Fig. 10 *a*. Side view of the head of *Amorphocephalus sulcicollis* (♂); 10 *b*, ditto, top view.
Fig. 11. Side view of the head of *Cordus hospes*, Germ., for comparison.
Fig. 12. Head and antenna of *Prophthalmus sanguinalis* (♀).
Fig. 13. Head and antenna of *Stratiorrhina xiphias* (♂), Westw. (*Arrhenodes*).

XLVII.—*Notes on the Mud-Tortoises of India* (Trionyx, *Geoffroy*). By Dr. J. E. GRAY, F.R.S. &c.

THE Three-clawed or Mud-Tortoises are a very natural and well-defined group; but the division of them into species has been a subject of great difficulty to European zoologists, chiefly arising from the very imperfect material which they have had at their command.

Formerly Geoffroy, Bell, and Fitzinger seem to have regarded the extent of the union of the ribs as a character of a species; the latter even attempted to divide them into genera from characters derived from this part. But it is now well understood that the extent to which the ribs are united depends entirely upon the age of the animal, the union being only partial in the young, and entire in the adult, as in the land tortoises and terrapins.

The number, extent, and shape of the sternal callosities no doubt afford very good characters for the distinction of the species, if adult animals are compared together; but they are gradually developed, and in some species (or perhaps in some individuals of the same species) they are much later developed and much longer in coming to their perfect state than they are in others. This is also the case with the development of the odd bone in front of the dorsal disk; so that these parts can only be used as characters when specimens of the same age and stage of development are compared, and especially specimens which have arrived at their adult state.

The sternum being furnished with flaps on the sides (which cover the legs when they are contracted), or being narrow at the sides and leaving the legs bare (as in most freshwater and marine tortoises), furnishes a most natural and easily observed character for the division of the group, and as such has been used by most authors. But it has been shown that each of these groups contains animals with very different skulls; and it is a matter of serious consideration whether the form of the skull, on which such important peculiarities in the animal economy depend, is not of more importance than the covering or exposure of the feet when they are withdrawn. When first the covering of the feet was observed, it was connected with a bony margin to the dorsal disk; but it is now well ascertained that many species with covered feet have the margin flexible and without bones, like the other mud-tortoises. It is to be remarked that all the tortoises that have flaps to cover their feet have callosities on the two anterior bones of the sternum, which have never yet been observed in those which have naked feet. This character is common to those that have thin skulls and jaws and narrow alveolar edge, and those which have thicker skulls and wider alveolar surface.

Cuvier and Wagler described and figured the skulls of two or three species of this group; but all the skulls which they had the opportunity of studying belonged to a single type of form, of a thick and solid consistency. In my 'Catalogue of Shield Reptiles in the British Museum' I figured a few skulls of the species which we then possessed, pointing out that they belonged to two different groups—one solid, and the other light and thin; and in the 'Supplement to the Catalogue of Shield Reptiles' I figured and described the skulls of many more species. I used this character to separate the soft-disk mud-tortoises into two families, Trionychidæ and Chitradæ—one having a solid, and the other a thin and light skull; and I divided the genera of each family according to the form of the skull, especially the form of the alveolar edge of the jaws. I consider this one of the most important steps towards the proper division of the species and defining them, as it affords us the power of dividing them into natural groups: for example, *Chitra indica*, *Trionyx gangeticus*, and *Tyrse nilotica* have been considered specimens of the same species, but they belong to two very different families; *Chitra indica* and *Pelochelys Cantori* have been regarded as the same species, the one having a very long ovate, and the other a short square skull. In the same manner *Fordia africana* and *Tyrse nilotica* (the one having a broad, flat alveolar surface, and the other a sharp thin one) have been regarded as the same species; whilst a Central-African tortoise, *Aspidonectes aspilus*, has been separated from *Tyrse nilotica* because the individual had slightly differently developed sternal callosities, whereas the examination of the jaws shows that they are the same species.

The study of the jaws at various ages has shown that the form of the alveolar surface is the same in the young as in the adult, and therefore furnishes a very excellent character for distinguishing the species; and if one had skulls of all the species in the collection, they would no doubt afford the characters of the various kinds, and also the best arrangement of them into groups. But, unfortunately, that is not the case, and we are obliged to do the best we can under the circumstances. Unfortunately, too, the skulls cannot be extracted from the stuffed specimens without destroying them; and it is always difficult to be certain that the skulls and skeletons that you receive belong to the species they are said to represent; for the characters by which the species are distinguished in their perfect state have been destroyed. Every care has been taken to prevent an error of this kind; and in general the characters of the genera have been taken from the examination of the head in the perfect animal, and of the skulls extracted from duplicate specimens. It is much to be regretted that the Indian zoologists do not study the numerous Asiatic species and give us the result of their examination, considering that there are only two Indian zoologists in modern times who have paid the slightest attention to these animals, and they have not yet learned the elements of herpetology. Thus Mr. Theobald and Dr. Anderson have described two most different animals under the name of *Trionyx Phayrei*, and have described them in such an incorrect and imperfect manner that it is impossible to make out to what species, or section, or genus either of them is referable.

The receipt of some additional specimens of mud-tortoises and their skulls required that they should be determined; and to do this I have been induced to study and revise what I had formerly written: as our materials are so imperfect, from the Indian collectors not sending home specimens, it is a matter of great difficulty. We know far less of the tortoises of our Indian possessions than we do of those of almost any other part of the world. Experience has shown me that the most reliable character for the distinction and arrangement of the tortoises, and especially of the mud-tortoises, is to be obtained by the study of the skulls; I have therefore been particular in collecting them, and (where it could be done without injury) have had the skulls removed from several of the specimens.

The result of this examination has been the discovery of serious mistakes, some of the separate skulls received having been assigned to the wrong species. Thus the skull which was thought to belong to the *Trionyx hurum* is found to belong to *Trionyx gangeticus* of Cuvier; the skull which was regarded and figured as belonging to *Potamochelys stellata* (and which was received as a present from Professor Oldham) is found to be the skull of a species of *Emyda*. Such mistakes were unavoidable with the very imperfect materials which we had at our command, and could only be corrected as more authentic specimens were procured.

MUD-TORTOISES (*Trionychoidea*).

General Hardwicke, of the Bengal Artillery, at the end of the last century made at Futteghur a series of drawings (now in the collection in the British Museum) of the mud-tortoises (*Trionyches*) which he obtained from the Ganges:—

1. The "*Sewteree*." This is the *Chitra indica* of the Catalogue of Shield Reptiles. The figure is copied in the 'Illustrations of Indian Zoology.'

2. The "*Kaavez*," which is the *Trionyx hurum* of the 'Illustrations of Indian Zoology' and of this paper.

3. The "*Dekoolee*," which is the *Trionyx gangeticus* of Cuvier and this paper.

Hardwicke figures the *Dhank* or *Jaank*, which appears to be a larger specimen of the same species.

4. The "*Bun-Goma*" or "*Turpin*," which is an *Emyda*, probably *Emyda punctata*. The figures of the young and old are copied in the 'Illustrations of Indian Zoology' as *Trionyx punctata*.

5. *Trionyx subplanus*; but it is from a dried specimen from Java. The figure is copied in the 'Illustrations of Indian Zoology.'

Dr. Buchanan-Hamilton, a friend and fellow labourer of General Hardwicke (who allowed Hardwicke to have copies made by his own artist of the greater part of the fish he described, which are now in the British Museum), figured many species of mud-tortoises of India. The collection of his drawings was in the India House, and is now in the India Museum at Westminster.

1. *Testudo dura* is *Emyda punctata*.

2. *Testudo hurum* is copied as *Trionyx hurum* in the 'Illustrations of Indian Zoology.' The *Trionyx hurum* of this paper.

3. *Testudo chin*. This is copied in Gray's 'Synopsis of

Reptiles,' tab. x., and is the same as the former, *Trionyx hurum.*

4. *Testudo ocellatus.* Copied in Gray's 'Illustrations of Indian Zoology.' Called *Trionyx ocellatus* there and in this paper.

5. *Testudo gataghol.* Copied as *Trionyx javanicus* in Gray's 'Illustrations of Indian Zoology;' but this now proves to be a new species of *Aspilus*, named *Aspilus gataghol* in this paper.

6. *Testudo chitra.* This is the *Chitra indica* of the 'Catalogue of Shield Reptiles in the British Museum.'

In my 'Synopsis of Reptiles' I described some of these drawings; and in the 'Illustrations of Indian Zoology' I published a selection from them, which I believe were the first published figures of Indian mud-tortoises. This book contains some mistakes in nomenclature; but it is to be recollected that when it was published (in 1831) there was not a single specimen of the Asiatic species of the family in this country.

In 1809 M. Geoffroy, in the 'Annales du Muséum d'Histoire Naturelle' (vol. iv. p. 1), formed the genus *Trionyx*, and described the species which had come under his notice. They are as follow:—

1. *Trionyx subplanus*, p. 15, tab. v. fig. 1. This species is established upon the bones of a dorsal disk; and the habitat is unknown. There is little doubt that it is the *Dogania subplana* of my 'Catalogue of Tortoises.'

2. *Trionyx ægyptiacus*, p. 12, tab. i. fig. 2, a beautiful figure of the back and lower surface of the animal, and of the bones of the back and sternum. This is the *Tyrse nilotica.*

3. *Trionyx stellatus*, p. 13. From the *Testudo cartilaginea* of Boddaert, which the French had taken from the Dutch museum; a young specimen, peculiar for having five stars in the hinder part of the carapace. It is not known from what country it came, and is in too bad a state to determine; Duméril and Bibron consider it the young of *Gymnopus javanicus.*

4. *Testudo carinatus*, p. 14, tab. iv., which represents the dorsal and sternal disks of a young half-grown specimen, of which we do not know the locality; but being without its head it is impossible to tell whether it belongs to *Trionyx, Platypeltis*, or any other genus that has four callosities. It is peculiar for having the front odd bone at a considerable distance from the dorsal disk. Schweigger changed the name of this species to *Trionyx Brongniartii*; and Bibron considered it the young of *Gymnopus spiniferus*, which he confounded with *Testudo ferox* of Pennant.

5. *Trionyx javanicus*, p. 15, tab. iii., representing the dorsal

disk without the odd bone, and the sternal disk with two narrow lateral callosities. From Java. Though it is without its head, I have no doubt that this is the *Aspilus cariniferus* of my Catalogue, which has the odd bone in front of the dorsal disk separate from the others, and smooth, except in the adult.

6. *Trionyx coromandelicus*, p. 16, tab. v. fig. 1, representing the dorsal disk. From Coromandel. This is a species of *Emyda*; but one has no means of knowing to which species of the genus it belongs.

The two following species he had not seen:—

7. *Trionyx georgicus* (the *Trionyx ferox* of Pennant). From North America. *Platypeltis ferox* of my Catalogue.

8. *Trionyx euphraticus*, p. 17 (*Testudo rafeht* of Olivier). From the Euphrates. *Rafetus euphraticus* of my Catalogue.

Schweigger published his 'Prodromus Monographiæ Cheloniorum' in 1814; but the manuscript was presented to the Institute before 1809, for it is quoted by Geoffroy in his essay; and it was originally printed in the 'Königsb. Archiv für Naturwissensch.' fasc. iii. & iv. Instead of the original name given by himself (*Amyda*), he adopts Geoffroy's genus *Trionyx* (p. 14), containing:—

1. *Trionyx ferox*, Pennant, from North America.
2. *Trionyx ægyptiacus*, Geoffr., from the Nile.
3. *Trionyx euphraticus*, Olivier (tab. 41), from the Euphrates.
4. *Trionyx javanicus*, Ann. du Mus. iv. tab. 3, from Java. "Boulouffe" according to Leschenault.
5. *Trionyx Brongniartii*, the *Trionyx carinatus*, Geoff. Ann. du Mus. iv. tab. 4.
6. *Trionyx granosus*, Schœpf, Test. tab. 30, *a* & *b*. An *Emyda*.
7. *Trionyx subplanus*, Geoffr. *Dogania subplana*.

Dr. John Wagler, in his 'Natürl. Syst. d. Amphibien,' 1830 (large folio), figures the following.

Tab. 2. fig. I. represents, under the name of *Aspidonectes javanicus*, a young animal, which may be the same as the *Trionyx javanicus* of Geoffr., whose figure of the dorsal disk (tab. iii.) he copies.

Tab. 2. figs. XIII.–XX., called *Aspidonectes gangeticus*, are copied from Cuvier's figures of the bones of *Trionyx gangeticus* of Duvaucel.

Tab. 2. figs. XXXIV., XXXV., *Aspidonectes carinatus*, are copied from Geoffroy's figures of *Trionyx carinatus*.

Tab. 2. figs. XXI.–XXXIII., bones of the various parts of *Trionyx coromandelicus*, Geoffroy (*Testudo granosa*, Schœpf). A species of *Emyda*.

Fam. **Chitradæ.**

Chitra.

1. *Chitra indica.* (The Sewteree).

"*Sewteree*," Hardwicke, icon. ined.
Trionyx ægyptiacus, var. *indicus*, Gray, Ill. Ind. Zool. i. tab. 80 (copy of Hardwicke).
Testudo chitra, Buchanan-Hamilton, icon. ined.
Trionyx indicus, Gray, Synopsis, p. 47.
Gymnopus lineatus, Duméril & Bibron, Erp. Gén. ii. p. 491.
Chitra indica, Gray, P. Z. S. 1864, figs. 11, 12 (skull); Cat. Shield Rept. B. M. p. 70, tab. 41 (skull).

General Hardwicke observes, "The *Sewteree* found in the Ganges grows to the size of 240 pounds;" with a green head and the back of the neck striped. It is described in the 'Suppl. Cat. Shield Rept.' under the name of *Chitra indica.* It is known by the eyes being very near the end of the nose, and, according to Hardwicke's figure, by being marked on each side of the pupil with a spot.

The top of the head and back of the neck are lined. It is different from all the other mud-tortoises in having an elongate ovate, very thin skull, with weak jaws, with only a linear alveolar process.

Hardwicke's figures are copied in Gray's 'Illustrations of Indian Zoology' (tab. x.) under the name of *Trionyx ægyptiacus*, var. *indica.* Buchanan-Hamilton had it in his drawings, figured under the name of *Testudo chitra*; in my 'Synopsis of Reptiles' I defined it as *Trionyx indicus*; and in the Tortoises of the British Museum, after examining the skull, I formed it into a genus under the name of *Chitra indica*, and figured its skull in the 'Catalogue of Shield Reptiles.' It is the *Gymnopus lineatus* of Duméril and Bibron ('Erpétologie Générale').

Fam. **Trionychidæ.**

* *Sternal callosities four, lateral and posterior; all broad and well developed in the adult.*

Nilssonia.

Skull rather elongate; nose shorter than the diameter of the orbit; alveolar process broader behind; separation between the alveolar surface and groove in the skull to the inner nostrils narrower, and deeper as well as narrower behind. Alveolar process of lower jaw very broad, especially in front, with a very deep, broad, longitudinal, central impression on the front half; rather concave on the hinder part of the sides, with a well-marked elevated ridge on the inner margin.

Skull in the British Museum, presented by Charles Falconer, Esq. (68. 2. 12. 15). It is known from the skulls of *Trionyx*, which it greatly resembles, by the narrowness of the groove in front of the palate to the internal nostrils; in *Trionyx gangeticus*, *T. Jeudii*, and in *T. Leithii* this groove is broad and shallow, and nearly of uniform width.

1. *Nilssonia formosa.*

Young only known. Callosities not developed.

Back of the crown with a broad transverse pale band.

Trionyx formosus, Gray, P. Z. S. 1869, p. 217, tab. 15. fig. 1; Suppl. Cat. Shield Rept. p. 99.

Hab. Pegu (B.M.).

The skull of the young is shorter and broader than those of the adults. I believe this arises only from difference of age.

TRIONYX.

The dorsal disk in the young animals is generally marked with three pairs of black spots, which have concentric pale rings within. These spots often last in a more or less perfect degree throughout the life of the animal; sometimes the anterior and sometimes the posterior pair, and rarely a spot on one side of these pairs, are deficient. The crown of the head of the young specimens is generally marked with spots of various colours, which become more and more indistinct as the animal grows. I believe that these spots are characteristic of the species; and sometimes whole series of species have characteristic spots—that is to say, on the sides of the crown and face.

† *Crown of head olive, with radiating black lines behind.*

1. *Trionyx gangeticus.* (Dekoolee.)

Skull short, broad; nose suddenly bent down, with a rounded outline; eyes within a very short distance of the cavity of the nostrils, which is not as long as the diameter of the orbit; alveolar surface of the lower jaw deeply concave, with a very slight, indistinct, central longitudinal ridge.

"*Dekoolee*," Hardwicke, icon. ined.

Trionyx du Gange, Cuvier, Oss. Foss. v. pt. 2, p. 187, tab. ii. figs. 5–8 (skull).

Trionyx gangeticus, "Duvaucel," Cuvier, Règne Anim. vol. ii. p. 16; Gray, Cat. Shield Rept. B. M. p. 66, Suppl. p. 97 (skull only).

Gymnopus Duvaucelii, Duméril & Bibron, Erpét. Gén. vol. ii. p. 47.

Aspidonectes gangeticus, Wagler, Amphib. Taf. 2. figs. 13–22 (copied from Cuvier).

Trionyx javanicus, Gray, Cat. Shield Rept. p. 67 (not synonyma).

Potamochelys stellata, Gray, P. Z. S. 1864, p. 85; Suppl. Cat. Shield Rept. B. M. p. 104 (animal only, not skull).

Var.? The black lines irregular.

"*Jaank*," Hardwicke, icon. ined.

General Hardwicke figures this species under the name of "Dekoolee," which grows to the weight of 120 pounds, and is found in the Ganges. The "Dekoolee" has been referred to the *Trionyx javanicus* of Geoffroy; but this is evidently a mistake, as that species is figured with two lateral transverse callosities, whereas all the more adult specimens of the "Dekoolee" in the British Museum have four well-developed callosities.

Cuvier, in the 'Ossemens Fossiles' (vol. v. pt. 2, p. 187), figures a skull under the name of "*Trionyx du Gange*" (tab. ii. figs. 5–8), and in the 'Règne Animal' he refers it to *Trionyx gangeticus*, Duvaucel (vol. ii. p. 16).

I find by comparison that the skull which I extracted from a half-grown specimen (but retaining the black rays on the crown, and having the four sternal callosities well developed) is exactly like the skull figured by Cuvier as the *Trionyx du Gange*, and by me under the name of *Trionyx gangeticus* in the 'Catalogue of Shield Reptiles' (t. 42. fig. 1).

Cuvier's figure most correctly represents the skull of this species, both in outline and in the proportion of the nose to the orbits, and in the form of the bones on the underside of the skull, which is very different from that of the skull of *T. Jeudii.*

There are now in the Museum four skulls of this species, of different sizes, which retain their characters most distinctly marked.

Duméril and Bibron change the name of this species to *Cryptopus Duvaucelii*, and quote *Trionyx hurum*, Gray (Synopsis of Rept. p. 49, tab. x.) as a synonym of this species. Believing that they had the original specimen to compare with my figure, I adopted their idea, and described the animal I so named as the animal of *Trionyx gangeticus*, Cuvier; but the examination of the skull of what I had called *Trionyx gangeticus* shows *that* to be the species the skull of which was figured and described by Cuvier when he established the species.

General Hardwicke figures a specimen of almost one uniform green colour, which, he says, is called "Jaank" or "Dhank" in the country, and is found in the Ganges and grows to the weight of 240 pounds. Unfortunately he does not figure the underside. The top of the head is green, marked with a series of rather irregular black lines; and there is one from the back edge of the eye, very different from the regular diverging lines of *Trionyx gangeticus*; but it may be only a variety, or it may be the *Aspilus gataghol* with a lined head figured by Hamilton.

2. *Trionyx Leithii.* (The Poonah Mud-Tortoise.)

A small species; the shield about 10 inches long and 6½ broad. The alveolar surface of the lower jaw nearly flat, with a very slight longitudinal ridge across the front end.

Hab. Poonah (*Dr. Leith*).

Dr. Leith gave the British Museum a stuffed specimen and a perfect skeleton of this species.

The head of the dried specimen, unfortunately, does not show any distinct indication of colour by which to distinguish it; but Mr. Charles Waterhouse thinks he can observe some obscure indications of olive stripes radiating from a centre in the hinder part of the crown. The skeleton is mentioned by mistake in the 'Supplement to the Catalogue of Shield Reptiles' (p. 102) under *Aspilus cariniferus*; and Dr. Günther had given this name to both specimens; it has four well-developed callosities to the sternum.

The skull is rather short and narrow; the nose shelving to the forehead, with a rather tapering outline. Eyes a very short distance from the cavity of the nostrils, not half as long as the diameter of the orbits. Alveolar surface of the lower jaw broad, very slightly concave, with a very indistinct central ridge in front, most elevated in the middle of the front central portion of the alveolar surface. The centre of the front edge of the lower jaw of the skeleton marked with a deep notch; but this may be only an individual peculiarity, because there is no indication of it in the stuffed specimen.

†† *Crown of the head olive, closely and minutely punctured with black.*

3. *Trionyx peguensis.*

Trionyx peguensis, Gray, Cat. Shield Rept. p. 99.

Hab. Pegu. Head and skull only known.

This is a large species. The skull has a broad palatal groove to the nostrils.

††† *The hinder part of the crown and sides of the head marked with pale spots.*

4. *Trionyx hurum.* (The Kaavez.)

Crown of the head varied with irregular black lines, a yellow spot on each side of the crown and at the back angle of the mouth.

"*Kaavez*," Hardwicke, icon. ined. B. M.

Trionyx hurum, Gray, Synopsis Rept. tab. x. (copied from Hardwicke); Ill. Ind. Zool. tab. (copied from Hamilton).

Testudo hurum and *T. chin*, Hamilton, icon. ined.

? *Trionyx Jeudi*, Gray, P. Z. S. 1869, p. 217, fig. 19; Suppl. Cat. Shield Rept. p. 97, fig. 32 (skull).

Hardwicke figures a second species, under the name of

"Kaavez;" it is found in the Ganges, and grows to the weight of 120 pounds. The top of the head in this species is brown, black-lined, with a yellow spot on each side of the crown and at the back of the angle of the mouth. This had been named *Testudo hurum* by Dr. Hamilton, and is the *Trionyx hurum* of my 'Synopsis of Reptiles,' tab. x. Duméril and Bibron referred this species and figure to *Trionyx gangeticus*; but this was certainly a mistake, and has been a fertile source of error.

It is figured as *Trionyx hurum* in Gray's 'Illustrations of Indian Zoology' from Buchanan-Hamilton's drawings, where it is called *Testudo hurum.*

Of this species there is no specimen in the British Museum; but I have a suspicion that the skull which I have described as *Trionyx Jeudi* (Proc. Zool. Soc. 1869, p. 217, fig. 19; Gray, Suppl. Cat. Sh. Rept. p. 97, fig. 32) probably belongs to this species.

The skull named *T. Jeudi* has the nose rather elongate, produced forward, with a rather tapering outline; orbit further from the cavity of the nostrils than the diameter of the orbit; alveolar surface of the lower jaw with a very distinct central longitudinal ridge in front, with a deep pit on each side.

The British Museum has a second skull of this species, which was given to us by Mr. Theobald as the skull of his *Trionyx Phayrei.* It certainly is not the skull of the species described under that name in the Journal of the Linnean Society, nor of the tortoise described under that name by Dr. Anderson.

5. *Trionyx sewaare.*

The upper surface of the head uniform olive, with a distinct yellow spot on each side of the crown.

"*Sewaare,*" Hardwicke, icon. ined. in B. M.
Trionyx gangeticus, var., Gray, Suppl. Cat. Shield Rept. p. 97.

Hab. Bengal.

Hardwicke figures a species under the name of "Sewaare," which grows to the weight of 160 pounds and upwards. It has a uniform brown head, with a large pale spot on the side of the crown behind the eyes, and a few similar spots on the back of the neck. The back is marked with six black eye-like spots. I know nothing of this tortoise in the adult state, and at one time considered it a variety of *Trionyx hurum*; but I believe that it is quite distinct.

There are in the British Museum two half-grown specimens (95 *a* & *b*) agreeing in some respects with these figures, one of which is marked with six spots, and the other has the anterior pair deficient. Unfortunately they are too young to have the sternal callosities developed.

There are in the Museum three half-grown specimens, possibly of this tortoise, which I mentioned under *Trionyx gangeticus* in the Suppl. Cat. Shield Rept. They may be only varieties of the preceding species.

6. *Trionyx ocellatus.*

Young only known. Callosities not developed; nose before the eyes with a broad lunate yellow spot.

Testudo ocellata, B. Hamilton, icon. ined.
Trionyx ocellatus, Gray, Ill. Ind. Zool. tab. (copied from Hamilton).
Gymnopus ocellatus, Duméril & Bibron, Erpét. Gén. iv. p. 9.

Hab. India (B.M.).

A young specimen in the British Museum is very like the *Trionyx ocellatus* of Gray (Illust. Indian Zool. tab. 78), copied from the *Testudo ocellatus* of Dr. Hamilton's drawings. It chiefly differs in the crown of the head being black and minutely punctate like the rest of the head, instead of being uniformly bluish as in the figure. It is at once known by the broad yellow lunate mark over the nose just before the eyes, and the large yellow spot behind each eye. Duméril and Bibron regard this as a species under the name of "*Gymnopus ocellatus*, Hardwicke;" and they refer to it *Trionyx gangeticus*, Guérin (Cuvier, Règne Animal, tab. 1. fig. 6), from specimens in the Paris Museum sent home by Duvaucel. This figure is not very characteristic.

Duméril and Bibron refer to *Trionyx gangeticus*, Cuvier, Règne Animal, tab. i. fig. 6; but the figure does not represent the characters of this species. And they also, curiously enough, refer to *Trionyx hurum*. They say that there are five specimens in the Paris Museum sent by Duvaucel; but they do not mention the peculiar broad yellow band across the nose, and their specimens may be only the young of *Trionyx gangeticus*.

7. *Trionyx Bellii.*

Young only known. Callosities not developed. Upper part of the head black, white-spotted on the crown, with a red spot on the sides of the temple and on the angles of the mouth.

Trionyx gangeticus, Cuvier, Bell's MS.; Gray, Tortoises, Terrapins, and Turtles, p. 11, tab. 51.

Hab. Asia.

I only know this species from Mr. Bell's figure. It is very like *T. ocellatus*; but the nose is black: the back of the crown is not to be seen, as the head is partially withdrawn.

Mr. Bell's specimen is probably in the museum at Cambridge with the rest of his collection.

Schlegel, in the 'Fauna Japonica' (tab. v. fig. 7), represents a head which he calls *Trionyx stellatus*, var. *japonicus*. The upper surface is pale-coloured, with pale spots on the edge of the lips and sides of the neck, the latter being the largest. At tab. vii. he figures the animal; but the specimen appears to be bleached. It probably belongs to this genus.

LANDEMANIA.

1. *Landemania perocellata.*

Trionyx perocellatus, Gray, Cat. Tort. B. M. p. 48; Cat. Shield Rept. p. 65, tab. 31.

Potamochelys? perocellatus, Gray, P. Z. S. 1864, p. 86.

Landemania? perocellata, Gray, P. Z. S. 1869, p. 216; Suppl. Cat. Shield Rept. p. 96.

Hab. China, Chusan.

Trionyx tuberculatus, Cantor's drawings; Gray, P. Z. S. 1861, p. 42.

Potamochelys tuberculatus, Gray, P. Z. S. 1864, p. 87; Suppl. Cat. Shield Rept. p. 105.

Hab. Chusan.

I believe this is the same as the preceding, as is also the half-dried specimen called *Landemania irrorata*, Gray, Suppl. Cat. Shield Rept. p. 96, fig. 1 (sternum). They all have a black streak from the back edge of the eye, extending along the upper part of the side of the neck.

POTAMOCHELYS.

The genus *Potamochelys* of Fitzinger, as restricted by me in the 'Proceedings of the Zoological Society' for 1864 and 1869 and in the 'Supplement to the Catalogue of Shield Reptiles' (p. 104, fig. 34), should be erased from the system. The skull figured (which was presented to the museum by Prof. Oldham), now that we have other skulls to compare with it, proves to be the skull of an *Emyda*, with the figure of which in Wagler I had compared it when I first described it. The animal described as *Potamochelys stellatus* proves to be *Trionyx gangeticus* of Cuvier, having no alliance with *T. javanicus* of Geoffroy, which is an *Aspilus*.

I feel considerable regret but no shame in making this confession, when one considers the very imperfect materials I had to work on when I wrote the "Revision of the Species of Trionychidæ;" and any person who will follow my papers on the different genera of that family will see the disadvantages under which I laboured, and how I had to feel my way as specimens illustrative of the subject were gradually received.

DOGANIA.

Dogania subplana.

Trionyx subplanus, Geoffr. Ann. du Mus. iv. p. 15, tab. v. fig. 1; Cuvier, Oss. Foss. v. pt. 2, tab. xiii. fig. 5 (dorsal disk only); Gray, Ill. Ind. Zool. tab.

Gymnopus subplanus, Duméril & Bibron, Erpét. Gén. p. 492.

General Hardwicke in his drawings figures the upper and lower surfaces of a stuffed animal, which I believe he received from Java, without a name. These figures are copied in the 'Illustrations of Indian Zoology' under the name *Trionyx subplanus*, Geoffr.

The specimen was young and had not the sternal callosities developed.

MM. Duméril and Bibron, because the animal is figured by Hardwicke, erroneously say it lives in the Ganges.

This animal is not known in the adult state. The specimen described as *Sarbieria frenata* (Suppl. Cat. Shield Rept.) is evidently a specimen of this species approaching to maturity, having four slightly developed callosities, as the specimen described as *Dogania Güntheri* also has; so that I have no doubt that the adult animal has four well-developed callosities, and the odd front bone united to the rest of the dorsal disk.

** *Sternal callosities two, lateral; broad and well developed in the adult.*

RAFETUS.

1. *Rafetus euphraticus*, Gray, Cat. Sh. Rept. p. 103.

*** *Sternal callosities two, lateral, narrow, linear, on the suture between the pair of lateral bones.*

ASPILUS.

The front odd bone of the dorsal disk is small and smooth, with a central rounded callosity in the adult.

The palatine groove in *Aspilus javanicus* is moderately narrow, rather deep, and of the same diameter through the whole of its length.

† *Forehead with radiating black lines.*

1. *Aspilus gataghol.* (The Gataghol.)

Testudo gataghol, Hamilton, icon. ined.

Trionyx javanicus, Gray, Ill. Ind. Zool. tab. (copied from B. Hamilton).

Hab. India.

This mud-tortoise is very like *Trionyx gangeticus* with its radiated head; but Buchanan-Hamilton's figure shows only two very narrow lateral callosities. I have never seen this species.

†† *Head white-spotted.*

2. *Aspilus javanicus.* (The Boulousse.)

Amyda javanica, Schweigger's MS., quoted by Geoffroy.
Trionyx javanicus (*Trionyx de Java*), Geoffr. Ann. du Mus. vol. iv. p. 15, tab. iii. fig. 2.
Aspidonectes javanicus, Wagler, Amphib., Atlas, tab. 2. figs. iii.–xiii. (fig. iii. copied from Geoffroy).
Trionyx carinifera, Gray, Cat. Shield Rept. B. M. p. 67, t. 32 (from a specimen in spirit).
Aspilus cariniferus, Gray, P. Z. S. 1864, figs. 4–6 (skull), 1869, p. 213; Suppl. Cat. Shield Rept. p. 101, fig. 33 (skull).
Gymnopus javanicus, Duméril & Bibron, Erpét. Gén. p. 493.

Hab. Java.

Schlegel, in the 'Fauna Japonica' (tab. v. fig. 6), figures the head of a mud-tortoise under the name of *Trionyx stellatus*, var. *javanicus*, which is mottled above and below and probably represents this species.

3. *Aspilus ornatus.*

Trionyx ornatus, Gray, P. Z. S. 1861, p. 41, tab. v. (young).
Aspilus? ornatus, Gray, P. Z. S. 1864, p. 85; Suppl. Cat. Shield Rept. p. 103.

Hab. Camboja.

Fam. Emydidæ.

EMYDA.

General Hardwicke figures a spotted example of this genus with the upper part of the head spotted, which is copied as *Trionyx punctatus*, jun., in Gray's 'Illustrations of Indian Zoology.'

General Hardwicke figures a much larger specimen from Futteghur, which he says is called "*Bun-Goma*," which is the country name for the land-turtle commonly called "*Turpin.*" The lower side shows the sternal callosities well developed. These figures are copied in my 'Illustrations of Indian Zoology' under the name *Trionyx granosus.* The back is uniform olive-green; and the upper part of the head, neck, and limbs is green, with two pale orange spots, one on each side of the back of the crown. I do not know whether this difference of colour depends on age or not.

Buchanan-Hamilton, in his drawings, calls this tortoise *Testudo dura.*

Geoffroy describes the species of this genus as *Trionyx coromandelicus* (Ann. du Mus. iv. p. 16, tab. v. fig. 1).

The skull is figured as *Potamochelys stellatus*, Gray, P. Z. S. 1864, p. 85, figs. 7 & 8 (skull); Suppl. Cat. Shield Rept. p. 105, fig. 34 (skull only).

Schlegel figures the head of *Trionyx granosus* ('Fauna Japonica,' Chelon. tab. v. fig. 4). It is of uniform colour.

XLVIII.—*Notes on a Deep-sea Dredging-Expedition round the Island of Anticosti, in the Gulf of St. Lawrence.* By J. F. WHITEAVES, F.G.S. &c.

UNTIL last summer (1871), so far as I am aware, no dredging-operations have ever been conducted in the deepest parts of the River and Gulf of St. Lawrence. In 1867 and 1869 I dredged in upwards of fifty different localities north of the Bay of Chaleurs, but never in deeper water than 50 fathoms. The researches of Dr. Packard and others on the coast of Labrador, those of Principal Dawson, Prof. Bell, &c. in the Gaspé district, together with those of Mr. Willis on the Nova-Scotian coast, were all conducted in comparatively shallow water. On several occasions I have called the attention of the Natural-History Society of Montreal to the importance, from a scientific point of view, of a careful investigation into the nature of the animal and vegetable life of the greater depths of the gulf, which seemed to me to promise a rich harvest of new facts.

A committee was appointed to petition the Dominion Government to allow qualified observers facilities for deep-sea dredging on board government vessels. Principal Dawson also, as President of the Society, represented to the Honourable the Minister of Marine and Fisheries the practical value of, and the useful results that might accrue from, such inquiries, and met with the most liberal response. The desired facilities on board government cruisers were at once promised, the necessary rope was provided, and no efforts were spared to make the cruises successful. I was deputed by the Natural-History Society to undertake the management of the expedition, and left Montreal early in July 1871. My friend Mr. G. T. Kennedy, M.A., of Montreal, an ardent zoologist, started with me, but returned after he had been a few days at sea.

The first cruise was on board the government schooner 'La Canadienne,' and lasted three weeks. The ground examined on this vessel was from Point des Monts (on the north shore of the St. Lawrence) to the Mingan Islands, then round the west point of Anticosti, and from there, in a diagonal line, to Gaspé Bay. Next, embarking on board the 'Stella Maris' at Gaspé Basin, we made an entire circuit of the island of Anticosti, sailing as far to the north-west as Sawhill Point, on the north shore, and to the south-east as the Magdalen Islands. We were driven to Bryon Island, one of the Magdalen group, by a "nor'-wester," which of course prevented our dredging there. As these investigations were entirely subordinate to the special duties upon which the two schooners were engaged, dredging could only be carried on at intervals, and in several cases the same ground was gone over twice or more.

On 'La Canadienne' we had sixteen successful hauls of the dredge. Of these, four were in 50 fathoms of water or less, seven in between 50 and 100 fathoms, and five in from 100 to 200 fathoms.

On the 'Stella Maris' we had nine successful hauls. One of these was in less than 50 fathoms, two were between 50 and 100, and six between 100 and 250 fathoms.

The deep-sea mud, in the places examined, is dotted over with (for the most part rounded) masses of rock, usually of Laurentian gneiss, varying in size from that of a pea to considerably larger than a man's head. By a modification of the usual sieving process every organism, piece of rock, &c. larger than $\frac{1}{16}$ of an inch in diameter was first picked out from the mud. A large bagful of the mud thus sifted, from each locality examined, was preserved for subsequent microscopic examination. Three fourths of this mud was found to be a silt so impalpable as, when wet, to pass readily through fine cambric; the remaining fourth consisted half of organic, and half of inorganic matter. The organic matter comprised a few diatoms, multitudes of Foraminifera, some Polycystina, many sponge-spicules, and fragments of other organisms. The inorganic débris was a more or less coarse kind of sand, made up of fragments of quartz, bits of felspathic rocks, and small flakes of mica.

Attempts were made to endeavour to ascertain the approximate temperature of the deep-sea mud. When the dredge was hauled up, its contents were emptied as quickly as possible into a large shallow tub; and this was covered with a tarpaulin and placed in the shade. An ordinary thermometer, with a metal case and perforated base, was then plunged into the mud, and the whole was kept carefully shaded for some time. With one exception, the temperature of the mud was found to be from 37° to 38° Fahr., and this not alone in deep water; for sand brought up from 25 fathoms, on the north shore of the St. Lawrence, also made the mercury sink to 38° or 37° Fahr. In the centre of the river, between the island of Anticosti and the south shore of the St. Lawrence, mud brought up from 200 fathoms only made the mercury sink to from 43° to 45° Fahr. Either a warm current affects the temperature of the bottom at this point, or else my observations were inaccurate or defective, which latter assumption is by no means unlikely.

On one occasion a somewhat curious phenomenon occurred.

We had been dredging in the afternoon in 212 fathoms, between the east point of Anticosti and the Bird-rocks. About 600 fathoms of rope (made of cocoanut-fibre) had been paid out, which when hauled in was, of course, wet. About ten o'clock the same evening we threw the dredge over in 250 fathoms water, and again all the coils were paid out. As the line went over the side it was luminous throughout its entire length with electric sparks! The closest examination with a triplet lens failed to disclose any trace of animal life entangled in the strands.

With a view of trying to get some information as to the nature of the food of some of the surface-feeding fishes, and especially of the herring and mackerel, towing-nets were frequently used; but scarcely any thing was taken in these. I attribute these failures to the circumstance that the towing-nets were only used in the *daytime*; had they been employed at night the results might have been different. Hempen tangles, similar to those devised by Captain Calver, were employed with some success; but the mistake was made of placing these some 20 fathoms or so *in front* of the dredge, instead of behind and on each side of it.

The following is a brief sketch of some of the most interesting forms of animal life obtained during the expedition. During the autumn of 1871, Mr. J. Gwyn Jeffreys, F.R.S., visited Montreal, and went over the whole of the testaceous Mollusca with me. I am also indebted to Professors A. Agassiz, A. E. Verrill, and S. J. Smith for the identification of several critical species.

FORAMINIFERA.

Large quantities of these beautiful organisms were collected, especially from very deep water, but at present only a portion of these have been carefully examined. In Mr. G. M. Dawson's paper on the "Foraminifera of the River and Gulf of the St. Lawrence," published in the 'Annals' for February 1871, a list is given of fifty-five subspecies or varietal forms. Among the specimens collected last year in deep water are a number of large specimens to which it is difficult to attach any name, but which form a series connecting the subgenera *Nodosaria*, *Dentalina*, *Marginulina*, and *Cristellaria*. One of the most remarkable of these is a *Marginulina* fully one eighth of an inch long, from the first chamber of which long spines proceed (at various angles), which, when perfect, must have been as long as the shell itself; these long spines vary in number from one to three; and besides these there are others which are either rudimentary or imperfect. *Cristellaria crepidula* and *Tro-*

chammina incerta were collected in comparatively shallow water (30 to 40 fathoms); and *Bolivina punctata, Nonionina umbilicatula, Vulvulina austriaca,* and gigantic examples of the *true Triloculina tricarinata* (reminding one of miniature beech-nut seeds carved in ivory) were dredged in from 200 to 250 fathoms. By far the greater number of the St.-Lawrence Foraminifera seem to have a wide range in depth. I have examined large bagfuls of dredgings from more than fifty localities in the northern part of the gulf, and out of fifty or sixty species or varietal forms, only four or five seem peculiar to deep water. *Virgulina squamosa, Bolivina costata* and *squamosa, Nonionina umbilicatula,* and the typical *Triloculina tricarinata* are only met with in apparently from 200 to 300 fathoms water. In the St. Lawrence, *Lagena distoma* (typical), *Bulimina pyrula* and *marginata,* and *Vulvulina austriaca* are characteristic of deep water, but are very rarely met with in lesser depths. *Globigerina bulloides,* though small, is not unfrequent at all depths; but, curiously enough, *Orbulina universa* has not yet been found living in Canada. Although many of the Foraminifera from the deep water are small and delicate, by far the largest specimens yet collected were taken in from 200 to 250 fathoms. This agrees with the result of Dr. Carpenter's observations on board the 'Porcupine.' The *Rhabdopleura* figured by Mr. Dawson I believe to be an annelid-tube, having examined the animal in a living state.

POLYCYSTINA.

Dictyocha aculeata and a species of *Ceratospyris* have been previously catalogued from the Gulf of St. Lawrence by Principal Dawson. Three additional species were dredged in upwards of 200 fathoms; but these are at present undetermined. In Canada, Polycystina are not peculiar to deep water; for I have taken fine specimens from the interior of a species of *Halichondria,* also from the stomach of *Echinus dröbachiensis,* both collected from a little below low-water mark.

SPONGES.

Several examples of the *Grantia ciliata* of O. Fabricius were dredged from 96 fathoms in Trinity Bay, on the north shore of the St. Lawrence. It is the first sponge with calcareous spicules recorded from the Gulf. The straight spicules of the terminating cone and the triradiate ones of the body of the sponge, make beautiful polariscope objects. A fine species of *Polymastia* was abundant in many places in deep water. In 38 fathoms off Cap-Rosier lighthouse a massive *Halichondria* was dredged, which, besides the ordinary smooth, curved, fusiform spicules, has small retentive *bihamate* ones, apparently resembling those of Dr. Bowerbank's *H. falcula* in all but size. The other sponges collected are as yet undetermined.

HYDROZOA.

Thuiaria thuja and *articulata* and *Campanularia verticillata* have been noticed among the specimens collected, which, however, have yet to be examined.

ACTINOZOA.

The two common sea-anemones of the New-England coast, viz. *Metridium marginatum*, Say (which is probably a variety of the European *Actinoloba dianthus*), and *Urticina crassicornis*, Ehr., were found as abundantly living in the greatest depths examined as in very shallow water. Prof A. E. Verrill recognizes a species of *Zoanthus* in some specimens which I sent him, which were dredged in 212 fathoms, between Anticosti and the Bird-rocks. Among the same specimens he has also detected examples of his *Eunephthya glomerata*, an Alcyonoid previously known only from Greenland and the banks of Newfoundland; also a new species, and perhaps genus, near to *Cornularia*. A large number (50 or 60) of living specimens of a *Pennatula*, which I believe to be new to science, was dredged in from 160 to 200 fathoms, between the island of Anticosti and the south shore of the St. Lawrence. In the largest specimens collected there are 40 pinnules on each side of the upper portion of the cœnosarc; but in average full-grown examples the number is less, and ranges from 30 to 35. On the back of the rachis there is a central groove, on each side of which are numerous but unequal, spinose, undeveloped polyps. The average number of polyp-bearing cells on each pinnule seems to be about 11, but varies from 9 to 16. The polyp-bearing cells are entirely separate, and are margined with bundles of spines. The 8 mesenteries and somatic chambers, as well as the 8 tentacles of the polyps, can be well made out in the specimens collected. In one specimen examined by Mr. G. T. Kennedy the basal portion of the pinnules is filled with spheres of granular matter. The spicules of the lower half of the stem are elliptical or oblong, and decidedly constricted in the middle. The calcareous internal axis is somewhat longer than the cœnosarc itself, and is recurved at the base. Large examples measure about 8 inches; but some are only 6 inches long, or even less. These latter specimens have as few as 21 pinnules on each side of the stem. The St.-Lawrence *Pennatula*, although resembling in some respects some of the varieties of *P. phosphorea* as described by Kölliker, seems nevertheless a distinct species, for which I venture to propose the name of *Pennatula canadensis*. On this point Prof. A. E. Verrill, to whom I sent specimens, writes to me as follows:—" I have spent considerable time on the *Pennatula*. It is *very near P. phosphorea*, and for a time I thought it would prove identical. So far as the figures and descriptions of the latter go it agrees very well, allowing that all the varieties and subvarieties recognized by Kölliker really belong to one species; but on comparison with Norwegian specimens, received from Copenhagen, it seems to be sufficiently distinct. The most evident differences are to be found in the more numerous, crowded, and unequal rudimentary or asexual polyps along the back of the stalk in your species, and in the greater smoothness of the peduncle, due to the much smaller size of the spicula of the integument in the American species." For many of the details respecting this species I am indebted to my friend Mr. G. T. Kennedy, M.A., of Montreal, who has kindly helped me in the dissection of specimens.

ECHINODERMATA.

Two fine living examples of *Schizaster fragilis* (the *Brissus fragilis* of Düben & Koren) were dredged, one off Cap-Rosier lighthouse, in 125 fathoms, the other from 200 fathoms, in the centre of the river, between Ellis Bay, Anticosti, and the south shore. Off Sawhill Point, on the north shore, the dredge brought up, from 69 fathoms, a curious Asterid covered with long and slender spines. Prof. Agassiz, to whom I sent the only specimen collected, informs me that it is identical with a species dredged on the 'Porcupine' expedition, and subsequently named by Prof. Wyville Thomson *Calveria hystrix*. Prof. A. Agassiz thinks that this Asterid may be the *Solaster furcifer* of Düben & Koren. Unfortunately two widely different Echinoderms are called *Calveria hystrix* in the 'Proceedings of the Royal Society.' The St.-Lawrence starfish is the "singular Asterid allied to *Pteraster*," but *not* the Echinoderm "belonging to the *Diadema* family," to both of which the same name is given. *Ctenodiscus crispatus*, Düben & Koren, was abundant in every haul at depths greater than 100 fathoms. *Amphiura Holböllii*, Lütken, and *Ophiacantha spinulosa*, Müll., were also frequent in deep water. Large living examples of *Ophioglypha Sarsii*, Lütken, were dredged in 125 fathoms off Cap-Rosier lighthouse, and a few fine specimens of *Astrophyton Agassizii* were taken, from 60 fathoms mud, off Thunder River.

ANNELIDA.

By far the most numerous of the denizens of the deep-sea mud in the St. Lawrence are marine worms. Apparently about 20 or 30 species were collected; but none of them has as yet been studied or determined.

CRUSTACEA.

Hempen "tangles" used in 212 fathoms water, to the south-east of the east point of Anticosti, brought up several living examples of a *Pycnogonum*, which is Dr. Stimpson's *P. pelagicum*, but which does not seem to differ from the *P. littorale*, Ström, of European seas. A fine specimen of *Nymphon giganteum*, Goodsir, was dredged in 125 fathoms off Cap-Rosier lighthouse. On the authority of the Rev. A. M. Norman's 'List of the Crustacea of the Shetlands,' I had quoted this (in a report printed by the Department of Marine and Fisheries for the Dominion) as Johnston's species; but Prof. S. J. Smith informs me that it was Goodsir who first described it. Several examples of *Munnopsis typica*, M. Sars, were taken in 125 fathoms off Cap-Rosier lighthouse. Several curious Amphipods were taken, among the more conspicuous of which were fine specimens of an *Epimeria*, which Mr. Smith refers doubtfully to *E. coniger* of Boeck. No large Decapods were dredged from deep water; the only specimens observed were a few shrimps. Mr. Smith recognizes the following critical forms of Macrura in a small series which I sent to him for identification:—

Pandalus annulicornis, Leach. 96 fathoms, Trinity Bay, and 125 fathoms off Cap-Rosier lighthouse.

Hippolyte Phippsii, Kröyer, with the preceding species.

Hippolyte Fabricii, Kröyer. 125 fathoms, off Cap-Rosier lighthouse.

Hippolyte polaris, Kröyer. 38 fathoms, off Cap-Rosier lighthouse.

POLYZOA.

Good specimens of the following species have been determined, from depths of from 90 to 250 fathoms; but many interesting forms are at present unnamed:—

Crisia eburnea, *Linn.*
Idmonea atlantica, *Forbes.*
Defrancia lucernaria ?, *Sars.*
Alcyonidium gelatinosum, *Pallas.*
Scrupocellaria scruposa, *Linn.*
Gemellaria loricata, *Linn.*
Caberea Ellisii, *Flem.*
Bicellaria ciliata, *Linn.*
Acamarchis plumosa, *Pallas.*
Flustra Barleei, *Busk.*
Retepora cellulosa, var.
—— elongata, *Smitt.*

TUNICATA.

The following is a list of the few species of this order at present identified by Prof. A. E. Verrill:—

Ascidiopsis complanatus (= *Ascidia complanata*, Fabr.). In 212 fathoms to the south-east of the east point of Anticosti.

Eugyra pilularis, Verrill. In 50 fathoms off the St. John's River, Mingan.

Botryllus, a purple species, distinct from *B. Gouldii*, Verrill. Attached to *Flustra Barleei*?, Busk, from 96 fathoms in Trinity Bay.

Several examples of *Amouroucium glabrum*, Verrill, were collected in and just outside of Gaspé Bay, where I had previously dredged it in 1869.

MOLLUSCA.

In the 'Canadian Naturalist' for 1869, I published a catalogue of 114 species of marine Mollusca inhabiting the Gulf of St. Lawrence, to the north of the Bay of Chaleurs. We now know localities for 150 species which inhabit the region in question. The shells collected last summer have been carefully studied; and the following is a list of some of the most interesting among them *.

Terebratula septentrionalis, Couth. In 112 fathoms, stones, off Charleton Point, Anticosti, and in 212 fathoms to the S.S.E. of the east end of that island.

Terebratella spitzbergensis, Davidson. 38 fathoms, stones, off Cap-Rosier lighthouse, alive, adult, and frequent; 96 fathoms, in Trinity Bay, one young, but living example; 112 fathoms, off Charleton Point, Anticosti, one dead, adult. Most abundant in somewhat shallow water.

Pecten grœnlandicus, Chemn. Taken alive in several localities in from 160 to 250 fathoms, mud.

Lima sulculus, Leach. Fine specimens in 38 fathoms, off Cap-Rosier lighthouse.

Arca pectunculoides, Scacchi (= *A. raridentata*, Searles Wood). Dredged on the north shore of the St. Lawrence, also between Anticosti and the south shore, in 160 to 170 fathoms. The specimens were often living, and of large size for the species. New to the western side of the Atlantic.

Arca glacialis, Gray (= *A. raridentata*, var. *major*, Sars). A few dead examples of this shell were taken with the preceding one.

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* I am indebted to Mr. J. Gwyn Jeffreys, F.R.S., for the determination of those species to which an asterisk is affixed.

Yoldia (? Portlandia) thraciæformis, Storer. One living specimen occurred in 212 fathoms, S.S.E. of the east point of Anticosti, and a dead, but perfect one, in 125 fathoms, off Cap Rosier.

Yoldia (Portlandia) lucida, Lovén. Living in seven of the localities examined, its range in depth being apparently from 150 to 250 fathoms.

**Yoldia (Portlandia) frigida*, Torell. Frequent, living with the preceding.

Dacrydium vitreum, Möll. In 212 fathoms, mud, to the S.S.E. of the east point of Anticosti, living. This and the preceding are new to America.

Cryptodon Gouldii, Philippi. Common, living, at all depths; it ranges from 10 to 250 fathoms.

Astarte lactea, Brod. & Sow. Fine in several localities. Off Sawhill Point in 30 fathoms; off Moisie village in 70 fathoms; mouth of St. John's River, Mingan, in 50 fathoms; Gaspé Bay. The young is *Astarte Richardsonii*, Reeve.

ASTARTE. Two species of *Astarte*, both of the *A. sulcata* group, were collected in deep water. One, of which two specimens only were dredged (off Bear Point, Anticosti, in 112 fathoms), I at first thought to be *A. crebricostata*; the other is by far the most abundant mollusk of the greater depths of the northern part of the river and gulf of the St. Lawrence. Mr. Jeffreys says that this latter shell is *Astarte sulcata*, var. *minor*. No specimens that I have seen, from American or European localities, exactly resemble either of these shells; and, in my judgment, both are new and good species.

Tellina (Macoma) inflata, Stimpson, MSS. Perhaps *M. fragilis* of Leach. Fine living specimens of a shell which the late lamented Dr. Stimpson gave to the writer some years ago, with the label "*Macoma fragilis*, St. MSS.," were dredged in 70 fathoms, sand, off Moisie village and at various depths in other localities.

**Neæra arctica*, Sars. Several living specimens of this species (the largest of which measures upwards of an inch and a quarter in its greatest breadth) were taken in 125 fathoms, off Cap-Rosier lighthouse; also in 200 fathoms, mud, Ellis Bay, Anticosti, bearing S.S.W. 27 miles distant.

**Neæra obesa*, Lovén (= *N. pellucida*, Stimpson). Off Caribou Island, on the north shore of the St. Lawrence, nearly opposite Cape Chatte, living, in 170 fathoms, mud. I regard both *N. arctica* and *N. obesa* as varieties of the European *N. cuspidata*, *N. arctica* being adults of unusual size, and *N. obesa* the young of the same species. In deference to Mr.

Jeffreys's greater experience, however, I keep the two forms separate. *N. arctica* has not previously been found on the American coast.

**Utriculus pertenuis*, Mighels. In 25 fathoms, sand, off Trinity River, also in Gaspé Bay; abundant at both localities. (Probably = *U. turritus*, Möller.)

Utriculus hyalinus?, Turton (=*Diaphana debilis*, Gould). With the preceding, but rare in both places.

**Philine quadrata*, Wood. Alive, from 212 fathoms, mud, to the S.S.W. of the east point of Anticosti.

Philine lineolata, Couth. Gaspé Bay, and off the St. John's River, Mingan, in 50 fathoms.

Dentalium abyssorum, Sars. Dead but good specimens of this species were dredged in three localities:—in 164 fathoms, mud, off Seven Island Bay; also in 160 and 200 fathoms to the S.W. and S.S.W. of Ellis Bay, Anticosti. New to America.

Siphonodentalium vitreum, Sars. Deep water, in several localities, fine and living. Most frequent in 200 to 250 fathoms; also new to the American side of the Atlantic.

Margarita argentata, Gould (=*M. glauca*, Möll.). Off the mouth of the St. John's River, Mingan, in 50 fathoms, and sparingly in other localities. Gaspé Bay.

Margarita striata?, Brod. & Sow. A remarkable variety of this species, with three unusually prominent revolving ribs (so much so as to remind one of some of the Australian Trochocochleas), occurred in 70 fathoms, sand, off Moisie village. The type is abundant and large almost everywhere in the St. Lawrence in shallow water.

Rissoa carinata, Mighels. Frequent, alive, from 96 fathoms in Trinity Bay.

Rissoa castanea, Möll. With the above, and elsewhere not unfrequent.

Rissoa scrobiculata, Möll. Collected in three localities, in from 125 to 250 fathoms, where it is large and fine. It occurs living, but of small size, in Gaspé Bay, at depths of from 20 to 30 fathoms.

Rissoella eburnea, Stimpson. One living and adult example, in 70 fathoms, off Moisie village.

Lacuna glacialis, Möller. A living adult specimen of this species was dredged from 96 fathoms in Trinity Bay. The shell is not a true *Lacuna*, and belongs, in my judgment, to a new genus.

Aporrhais occidentalis, Beck. A remarkable thin and inflated variety of this species was taken in 120 fathoms off Bear Head, Anticosti. The type is not uncommon throughout the gulf in from 20 to 50 fathoms.

Eulima stenostoma, Jeffreys. A single living adult was taken from 160 fathoms, to the south-west of Ellis Bay, Anticosti. New to America.

Astyris Holböllii, Möll. (= *Columbella rosacea*, Gld.). Trinity Bay, 96 fathoms, also other localities. Ranges from 20 to 100 fathoms.

Buccinum ciliatum, O. Fabr. Alive, in 112 fathoms, off Charleton Point, Anticosti.

Buccinum cyaneum?, Brug. From 250 fathoms, mud, between the east point of Anticosti and the Bird-rocks.

Sipho islandicus, Chemn. Only one living example of this mollusk was collected, from 112 fathoms, off Charleton Point, Anticosti.

Sipho Sarsii, Jeffreys. With the above, but much more frequent; also off Egg Island, in 70 to 80 fathoms. The epidermis is very different in these two species; but it is difficult to separate them when the specimens are water-worn.

Trophon craticulatus, O. Fabr. Off Cap-Rosier lighthouse, in 38 fathoms, stones, fine and living; also near the mouth of the St. John's River, Mingan, in 50 fathoms, sand, but dead.

Fasciolaria ligata, Mighels. Two living examples were taken in Gaspé Bay, near Cape Gaspé, on a stony bottom, in 20 or 30 fathoms.

Twenty-five species of shells not previously known to inhabit the seas of the Province of Quebec were collected during the two cruises; of these, twelve are new to the American side of the Atlantic.

Fishes.

The only fishes brought up in the dredge were a young specimen of each of the following species :—

Sebastes norvegicus. The Norway haddock. 96 fathoms, Trinity Bay.

Anarrhichas lupus. The wolf fish. 112 fathoms, off Charleton Point, Anticosti.

Agonus hexagonus?, Schneid. With the preceding.

It is estimated that, when the whole of the material collected has been examined with care and all the specimens are determined, upwards of 100 species of marine invertebrates new to the Gulf of the St. Lawrence can be added to its previously recorded fauna. Of these, from 30 to 40 species are new to the western side of the Atlantic, and a few are undescribed. When it is considered that only five weeks were spent at sea, that during this time the ordinary duties upon which the schooners were engaged (and sometimes unfavourable weather) often made dredging quite impracticable, also that I was alone (so far as scientific help was concerned) nearly the whole time, I may be pardoned for thinking that the results of these investigations, so far as they go, are very encouraging, and such as should stimulate to renewed exertions in so promising a field of inquiry.

I have previously shown (in the 'Canadian Naturalist' for 1869) that a large proportion of the Greenland invertebrates, probably three fourths of the whole, range as far south as the northern part of the Gulf of St. Lawrence down to Gaspé Bay. In Canada many marine animals (such as, for example, the oyster and the two species of *Crepidula* which are found attached to it) occur off the southern coast of the Bay of Chaleurs, but not in the northern part of the same bay. A number of characteristic New-England species inhabit the coasts of Nova Scotia and New Brunswick, which do not apparently range further north than the Bay of Chaleurs.

On the Admiralty Charts of the Gulf of St. Lawrence, an irregular line of shallow soundings may be seen to extend from a little above the northern extremity of the Island of Cape Breton, round the Magdalen group, and thence, in a westerly direction, to Bonaventure Island. To the south and southwest of this line the water is uniformly somewhat shallow, and never exceeds 50 fathoms in depth. To the north, northwest, and north-east of the same line the water deepens rapidly, and perhaps even precipitously. Principal Dawson suggests that the Subcarboniferous rocks of which the Magdalen Islands are composed, and which appear again on the mainland, in Bonaventure County, may possibly crop up under the sea in the area between the north-west side of Cape Breton and the mainland of New Brunswick, as well as that of the counties of Bonaventure and Gaspé, in the Province of Quebec. This would account, possibly, for the shallowness of the water in the area in question. Whether this is the case or not, it seems not improbable that this extended line of shallow soundings may form a natural barrier to those arctic currents, if any such there are, which sweep down the Straits of Belle Isle in a southwesterly direction, and may tend to deflect their course in a bold curve into and up the river St. Lawrence.

In the centre of this river, opposite Murray Bay, about 80 miles below Quebec, Principal Dawson has dredged quite a large series of Labrador marine invertebrates; but how much further up the stream these salt-water denizens extend, we have yet to learn.

North of the Bay of Chaleurs the fauna of the Gulf of St. Lawrence has a purely arctic character. The species of which it is composed are remarkable alike for their geological antiquity and for their wide range of geographical distribution. In time, a few of them date back to as ancient periods as the Coralline and Red Crags, and a much larger number occur in the Postpliocene deposits of both Europe and North America. It is curious to observe that species which are found both living on the American coast to-day and fossil in the European Pliocene and Postpliocene, had a different geographical range in former times from that which they are known to have now. Many of these arctic marine invertebrates are circumpolar in their distribution, and not only inhabit both sides of the Atlantic, but are also found in the Northern Pacific. The preceding generalizations refer almost exclusively to the assemblage of marine animals characteristic of comparatively shallow water, the members of which range in depth from low-water mark up to about 50 fathoms.

The deep-water fauna, at least that of the localities examined, is also decidedly arctic, but it has at the same time a much more Scandinavian aspect. Nearly all of the species which are now for the first time recorded as inhabitants of the Atlantic coast of America occur also in the seas of the north of Scotland, of Norway, and Spitzbergen. There is a striking similarity between the series of fossils from the Quaternary deposits of Norway (as catalogued by Sars) and the marine invertebrates of the deepest parts of the St. Lawrence. *Pennatulæ*, *Ctenodiscus*, *Tripylus* (*Schizaster*) *fragilis*, *Ophioglypha Sarsii*, together with many species of mollusks, are common to both. Still it must be borne in mind that in the Quaternary deposits of Norway a number of characteristic European invertebrates occur, which, so far as we know, do not live on the western side of the Atlantic.

In the River and Gulf of St. Lawrence, generally speaking, the number of species of marine animals which may be collected at or above low-water mark is very small; few specimens, apparently, are washed ashore by storms. But there is a constant tendency in the opposite direction; littoral and shallow-water forms are constantly being drifted down to lower levels, particularly shells (which are usually dead and empty) and the larger calcareous Polyzoa, such as *Celleporaria incrassata* and *Myriozoum subgracile*. Sometimes the Mollusca are living: on one occasion I dredged an example of *Littorina rudis*, apparently alive, but certainly with the operculum fitting tightly into the aperture, from upwards of 100 fathoms water. When such is the case, it is often difficult to separate the true denizens of the deep sea from those which are washed down from shallower water.

The Government of Canada (to whom I had the honour of presenting a report on this preliminary deep-sea dredging-expedition, with special reference to facts collected bearing on the fisheries) has decided that the prosecution of these inquiries shall be continued. A vote of a small sum of money has been passed, which will, it is hoped, defray the necessary expenses of the expedition. I propose to devote the months of July and August of the present year to endeavouring to dredge in the greatest depths of the River and Gulf of St. Lawrence, particularly in the deepest place to the west of Newfoundland. Between the east point of Anticosti and the Magdalen Islands, about halfway, and in an easterly direction towards Newfoundland, is the deepest part of the gulf. The bottom, at this locality, for several miles (nearly two meridians) has a depth of 313 fathoms. Last year we were unfortunate; for as soon as we were fairly on the ground, and had got every thing in readiness, a stiff north-west gale sprung up, which lasted sixty hours, and made dredging quite impracticable. It is hoped that in this respect our efforts will be more successful during the present season.

Montreal, July 12, 1872.

XLIX.—*Descriptions of new Myriopoda of the Family* Glomeridæ. By Arthur Gardiner Butler, F.L.S., F.Z.S., &c.

[Plate XVIII.]

The millipedes treated of in the present paper are all in the collection of the British Museum.

CHILOGNATHA.

Family **Glomeridæ***, Gervais.

Genus Zephronia, Gray.

1. *Zephronia chitonoides*, n. sp. Pl. XVIII. figs. 2, 2 *a*.

Brownish testaceous, inclining to castaneous; head and nuchal plate darker.

Head shining, external area coarsely rugose, central area coarsely punctured, inner margin bearing about fourteen minute teeth; dorsal segments highly polished, covered with exceedingly indistinct, almost obsolete, granulations; external margin of first segment rugose; last segment very oblique; segmental lateral wings much incurved in dried specimens, very oblique.

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* Variously designated *Zephroniidæ*, *Sphærotheridæ*, and *Polyzoniidæ*! (Wood, Proc. Acad. Nat. Sci. Philad. 1865, p. 172). In his 'Aptères,' M. Gervais restricts this family to the three genera *Polyzonium*, *Siphonotus*, and *Siphonophora*.

Length 1 inch 7 lines to 1 inch 3 lines; width at first dorsal segment 9 lines.

Hab. Madras and Ceylon (*Dr. A. Smith*). Four specimens. B.M.

Allied to *Z. Brandtii* of Humbert, but differing in the number of teeth on the back of the head, the projecting last segment, the incurved character of all the segments, the wings of which are narrower, the relatively narrower and more elongate character of the entire animal. We have *Z. Brandtii* under two distinct types of coloration; the darker form appears to be the adult type.

2. *Zephronia rugulosa*, n. sp. Pl. XVIII. fig. 1.

Very near to the preceding, but pale testaceous; the head, nuchal plate, and hind margins of dorsal segments olivaceous brown.

Head glabrous, external third very coarsely and densely punctured, inner margin bearing about ten small teeth; nuchal plate and dorsal segments distinctly rugose and sparsely punctured all over; segmental wings less oblique and broader than in the preceding species.

Length 7 lines; width 4 lines.

Hab. Ceylon (*R. Templeton*). One specimen. B.M.

3. *Zephronia noticeps*, n. sp.

Allied to *Z. chitonoides*. Brownish olivaceous; the eyes, antennæ, legs, and nuchal plate (except central area) green; front of head inclining to orange, central area crossed by three oval red spots.

Head glabrous, somewhat pilose in front, coarsely but sparsely punctured; hind margin bearing about eight small teeth; nuchal plate surrounded by a series of coarse punctures, several also scattered over its central area; dorsal segments dull, almost imperceptibly granulose, the last segment perceptibly punctured, especially behind; segmental wings almost as in preceding species.

Length 8 lines; width 4 lines.

Hab. Ceylon (*E. W. Janson*). One specimen. B.M.

4. *Zephronia corrugata*, n. sp.

Allied to *Z. inermis*, but paler in colouring, and with all the dorsal segments coarsely rugose.

Length 1 inch 8 lines to 7 lines; width 9 lines to 3 lines.

Hab. Ceylon (*R. Templeton*). Four specimens. B.M.

Possibly only a variety of *Z. inermis*, of which we have four examples from Madras and Ceylon.

5. *Zephronia leopardina*, n. sp.

Allied to *Z. inermis*, but pale testaceous, blotched all over with castaneous, and covered with minute, scarcely perceptible hairs; puncturing almost precisely as in *Z. inermis*.

Length 8 lines; width 4¼ lines.

Hab. Ceylon (*R. Templeton*). One specimen. B.M.

6. *Zephronia tigrina*, n. sp. Pl. XVIII. fig. 7.

Allied to *Z. corrugata*. Castaneous, with each of the dorsal segments, excepting the first and last, crossed by a band of ochre-yellow; head and front of first dorsal segment pitchy; hind margins of all the dorsal segments pitchy.

Head and nuchal plate covered with coarse punctures; dorsal segments very rugose; wings not angulated, but obliquely rounded off in front, and with well-developed anterior ridge.

Length 1 inch 7 lines; width 9 lines.

Hab. "East Indies" (*S. Stevens*). One specimen. B.M.

7. *Zephronia zebraica*, n. sp. Pl. XVIII. fig. 4.

Allied to *Z. tigrina*. Ochreous, head pitchy; front of nuchal plate and front margins of all the dorsal segments black; two irregularly triangular pitchy patches towards the front of last segment.

Head densely and coarsely punctured in front, otherwise sparsely punctured; a row of well-defined punctures along front of nuchal plate; all the dorsal segments sparsely punctured in front, last segment punctured all over.

Length 1 inch 11 lines; width 11 lines.

Hab. Near Bombay (*Col. Whitehill*). One specimen. B.M.

8. *Zephronia nigrinota*, n. sp. Pl. XVIII. fig. 9.

Allied to the preceding species. Dark olivaceous or castaneous, with dorsal segments slightly paler in front, and dotted here and there with black and sometimes with ochreous spots; head and nuchal plate pitchy.

Head glabrous, densely and coarsely punctured in front, irregularly and sparsely punctured behind; nuchal plate exhibiting a few coarse punctures here and there; dorsal segments almost imperceptibly granulose; segmental wings as in the preceding species.

Length 1 inch 3 lines to 1 inch 2 lines.

Hab. Sikkim (*Dr. Hooker*); Assam (*Warwick*). Six specimens. B.M.

9. *Zephronia lutescens*, n. sp.

Testaceous, sometimes clouded with olivaceous; head and nuchal plate pale olive and covered with short bristles.

Head coarsely punctured, external third densely punctured; nuchal plate with a row of coarse punctures in front; dorsal segments (excepting the front edge of the wings and the posterior portion of the last segment, which are somewhat rugose and pilose) polished and without punctuation.

Length 10 to 8½ lines; width 5½ to 5 lines.

Hab. India (*Mrs. Hamilton*). Two specimens. B.M.

Allied to *Z. glabrata* of Newport; but larger, broader, and with the nuchal plate and dorsal segments much less punctured.

10. *Zephronia ignobilis*, n. sp.

Testaceous, clouded with dusky olivaceous.

Head, nuchal plate, and dorsal segments densely punctured all over and clothed with short hair; segmental wings slightly curved and very pointed.

Length 4½ lines; width 2 lines.

Hab. Java (*Argent*). One specimen. B.M.

Allied to *Z. Lichtensteinii*; but without the shining dorsal ridge.

11. *Zephronia pilifera*, n. sp.

Brownish testaceous, spotted here and there with black, and clothed with short hairs; head and nuchal plate pitchy.

Head coarsely punctured, more densely in front; nuchal plate coarsely punctured; dorsal segments finely and densely punctured; wings curving slightly backwards.

Length 9 lines; width 4½ lines.

Hab. Ceylon (*R. Templeton*). One specimen. B.M.

Also allied to *Z. Lichtensteinii*. It differs also from the preceding species in size, colour, and the form of the segmental wings.

12. *Zephronia innominata*, Newport, MS. Pl. XVIII. fig. 8.

Testaceous, eyes and antennæ greenish.

Head coarsely rugose and punctured all over; nuchal plate densely and coarsely punctured; dorsal segments densely but minutely punctured, their external edges minutely pilose.

Length 1 inch 3½ lines; width 7 lines.

Hab. Philippines (*Cuming*). Two specimens. B.M.

Nearly allied to *Z. castanea* of Newport; but narrower, paler in colour, with broader terminal joint to antenna, and more distinctly punctured dorsal segments.

13. *Zephronia sulcatula*, n. sp. Pl. XVIII. fig. 5.

Allied to *Z. inermis*, rather paler and duller.

Head flatter than in *Z. inermis*, punctured in the same way;

nuchal plate without punctures; dorsal segments, excepting the last (which is delicately rugose), without punctures; all, excepting the first and last, longitudinally multisulcate.

Length 1 inch 11 lines to 1 inch 4 lines; width 1 inch to 9 lines.

Hab. Borneo (*W. Jeakes*). Eight specimens. B.M.

One example shows scarcely a trace of the sulcations on the dorsal segments.

Genus SPHÆROTHERIUM, Brandt.

1. *Sphærotherium latum*, n. sp. Pl. XVIII. fig. 3.

Castaneous, dotted here and there with blackish; mouth black; eyes crystalline white.

Head rugose and densely punctured in front, coarsely but sparsely punctured in the centre; nuchal plate sparsely punctured; dorsal segments delicately rugose, last segment also sparsely punctured.

Length 2 inches 1 line; width 1 inch 3 lines.

Hab. North Madagascar (*L. Bouton*). One specimen. B.M.

Allied to *S. Actæon* of White; but smaller, paler in colour, more depressed in outline, less rugose, and with lateral wings of segments less curved. The antennæ in *S. Actæon* are broken, which accounts for Mr. White not having more than hinted at its genus by comparing it with *S. hippocastanum*[*].

2. *Sphærotherium Neptunus*, n. sp. Pl. XVIII. fig. 6.

Olive-green, clouded and blotched with pale ochreous; the external margins of the segments dark ochreous. *Variety* pitchy, clouded with castaneous; the external margins of the segments castaneous.

Head coarsely and densely punctured in front, sparsely behind; nuchal plate with row of coarse punctures in front and two or three punctures behind; dorsal segments smooth and shining, the last sparsely punctured.

Length 2 inches to 4¼ lines; width 1 inch to 2 lines.

Hab. Madagascar (*Madame Ida Pfeiffer*); Port Natal (*Gueinzius*). Eight specimens. B.M.

Allied to *S. rotundatum* of Brandt, and agrees in many respects with the description of *S. Titanus*; but the last segment is not peculiar in shape.

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[*] A *Zephronia* (?) in the British Museum agrees pretty well with the description of the latter species; it will, however, doubtless prove to be distinct when an opportunity occurs of comparing it with authenticated examples of that species.

3. *Sphærotherium fraternum*, n. sp.

Closely allied to the preceding, but with head and nuchal plate coarsely punctured all over and clothed with short hairs, the dorsal segments exhibiting a number of small, rounded, whitish pustules.

Length 8¼ lines; width 5 lines.

Hab. Victoria, Australia (*Dr. Howitt*). One specimen. B.M.

4. *Sphærotherium nigrum*, n. sp. Pl. XVIII. fig. 11.

Shining black, antennæ clothed with reddish hairs.

Head glabrous, coarsely and densely punctured in front, sparsely behind; nuchal plate delicately rugose and coarsely but sparsely punctured; dorsal segments coarsely rugose and punctured, last segment densely punctured, its outer edge curving outwards so as to form a distinct projecting rim; lateral wings very slightly curved.

Length 1 inch 4 lines; width 8 lines.

Hab. South Africa (*Sir Andrew Smith*). One specimen. B.M.

A remarkable species, coming nearer to *S. grossum*, Koch, than to any other described form.

5. *Sphærotherium sinuatum*, n. sp. Pl. XVIII. fig. 10.

Closely allied to *S. dorsalis*, Gervais (*Zephronia pulverea*, White; *Sphærotherium retusum*, Koch), but smaller, without dorsal ridge, the punctuation of the head and nuchal plate finer, the lateral segmental wings curving distinctly backwards, and the depression of last segment reduced to a slight sinus.

Length 7½ lines; width 4 lines.

Hab. Sarawak (*Wallace*). One specimen. B.M.

L.—*On Coccoliths and Rhabdoliths.* By Oscar Schmidt[*].

[Plates XVI., XVII.]

I MUST preface my communications upon Coccoliths and a newly discovered kind of organized corpuscles from the *Bathybius*-mud, which I call Rhabdoliths, with a short report upon the course of that expedition in the lower part of the Adriatic Sea during which I first made a close acquaintance with these exceedingly remarkable corpuscles.

By working up the sponges captured during the sounding and surveying of the Florida coast, and incited by the English deep-sea soundings, the desire was raised in me to learn more accurately the conditions of the bottom of the Adriatic. My frequent dredging-voyages along the Dalmatian coast had hardly made me acquainted with a greater depth than from 40 to 50 fathoms. In presence of the surprising results of the investigations of the Atlantic sea-bottom, and their importance equally in zoology and geology, a supplemental examination of the sea near me appeared to be of general interest. But it was perfectly clear that this could only be undertaken with large resources; and for this purpose circumstances were peculiarly favourable. Considering the total deficiency of modern and fully trustworthy charts of the Adriatic Sea, a thorough survey of it could no longer be put off. This great work was confided by the Admiralty to Captain Œsterreicher with a number of officers. A smaller steamer was associated with the principal ship, the 'Triest,' a large and convenient steamer; and besides its rowing-boats the 'Triest' carried a steam-launch. As in the summer of 1870 it was proposed to lay down some lines between the Apulian and the Albano-Dalmatian coasts, I applied to Vice-Admiral von Tegetthof and Captain Œsterreicher, and received from them the most obliging permission and invitation to pass a few weeks with my friend Professor Gobanz as a guest on board the 'Triest,' and a promise that I should be as far as possible aided in my designs. Equally liberal was the assistance of the Imperial Academy with regard to our equipment. And so my companion and I found ourselves with the Lloyd's steamer, on the morning of the 20th of June, in the roads of Durazzo, where the 'Triest' was lying at anchor. We were cordially received by the gentlemen of the surveying-expedition, and I look back with pleasure and gratitude to every hour of my living in their company.

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[*] Translated by W. S. Dallas, F.L.S., from the 'Sitzungsbericht der k. k. Akad. der Wissenschaften in Wien,' Bd. lxii. (1870) Abth. i. pp. 669–682.

I had had dredges made upon two models:—one the frame of which was a narrow rectangle; and several with triangular frames, of which I have previously made use with good results. The only improvement (to which Professor Lovén had called my attention) was, that of the three bows which bear the ring for the rope, only two are riveted together, whilst the third is united with them by a somewhat thinner piece of rope. In the event of the catching of the dredge, this union will break more easily than the hawser, and the dredge will be more easily freed. I was never in a position to learn this by experience. The triangular dredge proved perfectly available down to depths of 630 fathoms, the greatest that we attained, when leaden weights of 80 lbs. were attached in the angles. As a tow-line, rope of the thickness of one's thumb was used; and in the absence of a small steam-engine for drawing it up, the numerous hands of the crew proved to be more than sufficient. During the operations with the dredge, the soundings and measurements of temperature were also carried on. With regard to the temperatures, I have as yet seen no connected series; but this portion of the operations of the survey will be worked out by Lieutenant Weyprecht. In the deepest parts of the gulf, with a surface temperature of 18° R., the temperature does not fall below 12°-10° R., so that these differences can hardly have any essential influence upon the development or repression of life. Moreover in the basin-like part of the Adriatic Sea in which we made our observations, the currents are remarkably small, and do not appear to affect the greater depths of several hundred fathoms. I place the extraordinary poverty of those deeps in all the higher forms of life chiefly to the account of this circumstance. On the upper parts of the Dalmatian coast, where the gulf is more narrowed, the shore-current is more perceptible, and the position of elongated islands and groups of reefs (*Scoglien*) gives origin to stronger local currents; it is precisely these regions that are endowed with the richest fauna and flora. As both Heller and myself ascertained, this abundance diminishes towards Ragusa, and below this point the coast is almost entirely sterile. On board the 'Triest' I investigated three lines with the dredge, namely Sasano-Brindisi, Bari-Durazzo, and Dulcigno-Viesti. The greatest depth of the first line was reached with 480 fathoms, and that of the third with 630 fathoms. The dredge could be so often cast, and, notwithstanding its simplicity, acted with such certainty, that from its contents a tolerably correct picture of the nature and population of the bottom must result. The first freshly examined sample of the bottom from 170 fathoms convinced me that I had *Bathybius*-mud before me. Its yellowish-grey colour and its exceedingly characteristic greasy nature were so well known to the officers that I was unanimously assured by them that this "primitive mud" predominates from the upper parts of the Adriatic Sea, alternating only here and there with a few extended sandy tracts. The soundings of previous years have confirmed this; and in like manner the dredge constantly brought me up this mud from all depths on all three lines. It was immediately seen that it is extremely rich in Foraminifera (predominantly *Globigerina*, *Orbulina*, *Uvigerina*, *Rotalia*, *Textularia*); but I looked in vain for other things which I had expected to find. A young and consequently not quite certainly determinable specimen of an *Echinus*, probably *E. melo* (=*Flemingii*?), from 230 fathoms, and an empty but perfect shell of *Terebratula vitrea* from 430 fathoms is the entire produce! That from the same depths some very young Bivalves, of scarcely ¾ millim. in diameter, made their appearance, whilst no trace of full-grown animals was to be found, can only be explained by the supposition that the larvæ furnished with their velum were driven unusually far into the open sea.

I turn now to the *Bathybius*-mud and the coccoliths. Very soon after my return, I published in the 'Ausland,' No. 30, a short notice of the discovery of these bodies at all depths in the Adriatic Sea, from 50 fathoms downwards, with the addition that they would no doubt be present also at less depths. I was consequently in advance of the publication of the extended investigations and discoveries of Gümbel, as he explained in No. 32 of the same journal. We have now a more detailed statement of these fine observations[*], which show the extraordinary diffusion of *Bathybius* and the coccoliths in all depths of all seas of the actual world, and the colossal part taken by them in building up the crust of the earth. I had also already made the discovery that the coccoliths are strongly represented in the raised land of Brindisi. Now, as Häckel also nearly at the same time investigated the coccoliths with his usual thoroughness[†], it might seem to be superfluous for me to go into the same subject.

But as Gümbel's work, so far as it is at present before us, extends only to the demonstration of the presence of coccoliths in the most various calcareous and marly deposits and in the sediments of the present day, and to certain reactions of *Bathybius*, and as I am obliged to conceive the structure of the coccoliths differently from Häckel in several points, and, finally, as, from the almost inconceivable importance of the coccoliths, any contribution to their more accurate knowledge must be welcome, the present memoir will carry with it its own justification.

I will first of all deal with a statement of Gümbel's, "that it is certainly conceivable that *Bathybius* takes its origin in the sarcode of the lower animals." He is led to this by the observation, "that when the shell of calcareous-shelled Foraminifera is dissolved away by dilute acid, their punctate membranes and granular flocks remain undissolved in the residue, which latter possess the form and reaction of *Bathybius*. These remains, indeed, may just as well be the residue of the sarcode of the Foraminifera as of our *Bathybius*, which had only been deposited in the cavities of the Foraminifera, and in this way comes again into view." The sarcode of the Foraminifera will very probably exhibit the same reactions as the protoplasm of *Bathybius*; so that I should by no means be inclined to deduce the identity of the two bodies in other respects from such a resemblance. But even before I had read Gümbel's communication in the 'Jahrbuch' it was known to me, by direct observation, not only that empty shells of Foraminifera are filled by *Bathybius*-mud, but *also that living Foraminifera incept* Bathybius-*flocks together with coccoliths, no doubt as nourishment.* The derivation of *Bathybius* from Foraminifera and other Protista is quite inconceivable when we consider the quantitative proportions. If we wash and strain off several pounds of Adriatic *Bathybius*-mud, there remains a minute heaplet of Foraminifera. And, further, the *Bathybius*-protoplasm, if supposed to originate from Foraminifera, would necessarily become decomposed before it could collect into such incalculable masses. *Bathybius* freshly taken out of the sea exhibits very sluggish movements, more sluggish even than those which occur in the sarcodic net of most sponges, but in other respects exactly the same phenomena which may be detected in specimens preserved in spirits of wine. This agrees exactly with my numerous comparative observations of fresh sponges and sponges preserved in spirit. Preparations of the finest sarcodic nets derived from the latter are absolutely undistinguishable, if we leave out of consideration the sluggish displaceability, from fresh preparations just taken out of the sea. I believe, therefore, that the further observation of the living *Bathybius* will furnish no particular information as to its nature.

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[*] Gümbel, "Vorläufige Mittheilungen über Tiefseeschlamm," N. Jahrb. für Mineral. &c. 1870, Heft 6.

[†] Häckel, "Beiträge zur Plastidentheorie," Jenaische Zeitschrift, v. 3.

At present the coccoliths seem to be inseparable companions of the *Bathybius*-protoplasm. It is a very different question, however, whether they merely live upon the soil of this protoplasm as independent organisms, or are products of it, as parts or organs. In what follows, an interpretation will come out, according to which the coccoliths pass through an independent cycle of development.

Both Huxley and Häckel admit that there are two different, although nearly allied, forms of coccoliths—namely, a simple disciform kind (the discoliths), and another which presents the form of a double disk united by a central pin (the cyatholiths). I must decidedly affirm that this distinction does not occur, and *that rather all those forms which Häckel has described as perfectly developed discoliths with an outer ring are cyatholiths*—in other words, that the outer ring is nothing but the margin of that shield which in the cyatholiths stands out better, from its somewhat greater removal from the other parts. Thus I have met with no supposed discolith the margin of which could not with patience be ascertained to be a constituent of an entire disk. I beg the reader who may have Häckel's work at hand to compare figures 25 (discolith) and 72 (cyatholith). Both, when looked at from the surface, have the same appearance; and even in 72, *e*, the margin of the larger disk appears, like *e* in 25, as the outer ring. If 72 when placed on the edge appears like figs. 33 and 62, whilst 25 in the same position gives an outline like fig. 44, this is due solely to the fact that in the latter case the inner circle and disk are completely concealed by the outer basin-shaped shield.

I desired at the beginning to call attention to this important point, as it essentially simplifies the question as to the structure of the coccoliths; and I will now pass to the special examination.

In Pl. XVI. fig. 15 a coccolith is shown from the flat or ventral side. The individual parts are named as follows by Häckel:—*a*, central granule; *b*, medullar space (*Markfeld*); *c*, medullar ring (*Markring*); *d*, granular ring (*Körnerring*); *e*, outer ring. I must remark that only in rare cases have I seen the medullar ring otherwise than as in my drawing and as Häckel figures it. It appears to me almost without exception as the simple contour of the medullar space, and only becomes more shaded when the medullar space acquires a more concave form. We now first trace the coccoliths to the development of the granular ring, which frequently becomes a *granular disk*. Numerous corpuscles with a simple or double contour, and from 0·001 to 0·004 millim. in diameter, appear as isolated central granules and as central granules with the medullar space (figs. 1, 2). The most important stage, however, in the development of the coccolith is that of the formation of the granular ring. Häckel characterizes this simply as a granulated zone; and, according to his figures, the material examined by him was already so much altered that the composition of the granular ring of actual spherical portions did not distinctly appear. Bodies like fig. 3 of our plate are not unfrequent. It consists of a lenticular central part, with a ring of from 7 to 10 balls. Häckel also has a similar structure in his fig. 10, which, however, according to his statement, consists of merely sarcodic granulations. The bodies of which I am speaking are solid, but may certainly have proceeded from a sarcodic foundation.

Although we may remain in doubt as to this category of corpuscles, this is no longer the case with another very frequent form. In fig. 4 we see the central granule and medullar space surrounded by a distinct circlet of balls; and from a comparison of a great number of specimens and stages, it appears that this ring of globules originates in a growth and subsequent division of the margin of the medullar space. The margin of the medullar space swells up; and such specimens as fig. 5 show that the marginal swelling is not formed uniformly, and only by degrees constitutes a perfectly closed circlet. Almost without exception, the whole structure, at the appearance of the circlet of balls, acquires the form of a bowl, at the same time that there is the greatest variability in the number of the globular portions and the size of the individual globules.

In two cases we have nothing more formed than a mere zone of globules or granules. This is shown in figs. 6, 7, 9, 10, 11. One case is, that only a circle of large globular portions surrounds the medullar ring. A very frequent case of this kind is shown by fig. 6, from the fresh *Bathybius*, and fig. 9, from the raised deposits near Brindisi. It is true, as I shall show hereafter, that here also completion may be effected by the outer ring, *i. e.* the dorsal disk; but in general the development of the body seems to be closed with the growth of the large globular portions; and I have no indication that these large globules break up into smaller portions. Such bodies as fig. 11 are excessively rare. It shows, in the circumference of the central disk, a circlet of large celliform balls; and this body also occurs but little altered in the deposits at Brindisi (fig. 10). The centres in the globules of the circlet appear quite distinctly to be condensed into a sort of nucleus, which also makes its appearance quite definitely, although irregularly, in the specimen from Brindisi.

In the second case (fig. 7) we find, instead of a simple circlet of globules, a granular zone, *i. e.* a zone in which small globules of about the diameter of the central granule are placed in from 2 to 4 rows side by side and partly over one another. Both this and the above described body may, as we show further on, cover themselves with the dorsal shield; but frequently this course of further development does not occur, and bodies are produced like fig. 8 and, more distinctly, fig. 12; they are hemispherical. In fig. 12 we are looking into the sphere; fig. 13 is the appearance from the side, fig. 14 from behind. Instead of a granular zone, a regular granular mantle is present. I am uncertain about the observation that sometimes an entire hollow sphere is produced. How the division into globular portions is compatible with the not unfrequent concentric striation, is not yet clear to me (fig. 8).

I give on Pl. XVII. figs. 16 & 17 a form of the incomplete coccolith which is not unfrequent. The central granule and medullar space are present, the latter undoubtedly as a disk. There is, however, no medullar ring; but what might be regarded as such is the actual margin of the medullar space. The granular zone is in course of production, although it does not appear in the whole circumference, but advances round the margin as an excrescence starting from a particular point.

When the development of the coccolith has taken a direction as in fig. 12, Pl. XVI., it appears to be concluded with the granular layer. In all other cases the coccolith usually becomes completed by the formation of a concavo-convex disk, which generally appears homogeneous, rarely irregularly notched and granular, and covers and more or less overarches the parts previously formed. As already mentioned, I have most decidedly ascertained that Häckel's so-called outer ring is never in connexion with the outer margin of the granular zone, but is only the margin of a regular shield projecting beyond the granular zone. In every object that I succeeded in turning and placing on its edge, I was able to trace and ascertain this dorsal shield.

In Pl. XVI. figs. 16, 17, and in Pl. XVII. most of the figures show the character and position of the dorsal shield. In figs. 1 and 2 the case is represented in which the central granule has attained a perfectly excessive development. This may furnish the explanation of a case occurring at Brindisi (Pl. XVII. fig. 18) in which not only is the central granule elevated, but its base and the part representing the medullar space appears granulated. This coccolith is completed by a strong granular ring. In figs. 3 and 4 (Pl. XVII.) the central granule is wanting. All these, and the other figures of discoliths with a dorsal shield (figs. 5, 6, 7, 10, 11, 12, 13, 14, 15), show individually and when compared with each other that in the centre of the convex side of the coccolith the dorsal shield is connected either with the medullar space itself, or with a peg-like prolongation of the part corresponding to the central granule. In the fresh state their union seems to be so firm, and perhaps elastic, that the dorsal shield is scarcely ever broken away. From the deposits at Brindisi, however, I have repeatedly obtained coccoliths like Pl. XVII. fig. 19, with a regular aperture in the centre of the medullar space, which I imagine to have been produced by the breaking away of the dorsal shield together with its pin.

From all these observations, therefore, the dorsal shield cannot be otherwise produced than by its gradually overgrowing the other parts from the dorsal pole of the coccolith. The observation of such intermediate stages is extremely difficult, because, up to the period when it projects beyond the circumference of the granular ring, it appears to adhere closely to the dorsal surface in the form of a most delicate lamella.

Pl. XVII. fig. 13 shows a coccolith from the dorsal side, and how the granular zone projects beyond the somewhat irregular outlines of the shield. A monstrous shield-formation may, however, occur, as in Pl. XVII. figs. 8 and 9, in which one half of the shield is completely adherent, whilst the other has grown out like a tongue. Rarely the margin of the shield is notched and so swelled as to resemble the margin of the granular zone, as in fig. 5.

We come now to a very important, and, it seems to me, quite unsettled question, namely that of the relation of the coccoliths to the *Bathybius*-protoplasm. Are they independent organisms? or are they organs or parts of *Bathybius*? In other words, do they propagate themselves by passing through a definite cycle of development, in which the *Bathybius*-protoplasm serves them as a soil? or does their formation occur as particles of the protoplasm? In the first place we have to examine whether the doubling of the central granule, with division of the surrounding parts, which is represented by Häckel in a series of figures, leads to any reproduction. Häckel simply states the fact, and says only that the elliptical discoliths are often distinguished by having a double central granule. But the importance of the central granule seems to be by no means great, as it is frequently wanting in otherwise perfectly regular and well-developed coccoliths. Many corpuscles with fissional processes or doublings occurring in *Bathybius* are either decidedly of a different nature or at least doubtful. Thus Pl. XVI. fig. 24 may be an Alga, and fig. 19 perhaps an Alga, but might also be a double central granule with a correspondingly divided medullar ring. With regard to corpuscles such as fig. 18, with a clear centre and turbid periphery, if we consider them isolatedly, we can scarcely make any supposition; but compared with the not unfrequent stages of coccoliths like fig. 20, they might be brought into connexion therewith. As we may ascertain by placing it on its edge, Pl. XVI. fig. 20 is a decided coccolith with a perfect dorsal shield; the dark non-granular part represents the granular zone, and the clear spaces in it a divided medullar space without central granules. Pl. XVI. figs. 22, 23, is unique in my knowledge. The structure and size leave no doubt that it is a coccolith; but the development in height is quite unusual. The dorsal shield has become a capsule open above; and the two central granules appear deeply immersed in it.

When I grasp the impression produced by numerous observations, compared with the facts of the reproduction of other low organisms, *the coccolith appears to me to be an independent living creature.* That *nutrition* and *growth* are performed by the central parts, the *granule* and the *medullar disk*, appears undoubtedly from their arrangement and the connexion of the other parts with them. The *dorsal shield* is nothing but a *covering piece*, and, notwithstanding its extent, of subordinate importance. In the globular and *granular zone*, however, I see the *reproductive apparatus*. In favour of this there are several reasons. So long as, like the previous observers, we discovered in the granular zone only quite indefinite granulations, the question as to the significance of this part of the coccolith could hardly be raised; but by the present investigation the granular zone must be placed in quite a different light. That the formation of the coccoliths starts from corpuscles which vary in form and size exactly like the globular and ellipsoidal portions of the granular zone, is easy to observe. Exactly the same scope that we see in the foundations of the coccoliths is repeated in the dimensions of the parts of the granular zone, from the small globules like those we find in coccoliths such as Pl. XVI. fig. 15, to the large lenticular bodies in fig. 11. The former are isolated as central granules; the latter appear as central granules with a medullar space. An intermediate step is formed by the globule in Pl. XVII. figs. 1 and 3; and their perfect picture is the central globule in Pl. XVI. fig. 3. The extraordinary variability of the mature coccoliths will therefore be in accordance with an equally wide scope in their foundations; and the multifarious forms of the coccolith-cycle, still by no means exhausted by Häckel and myself, prove (notwithstanding the identity of discoliths and cyatholiths) that we have to do with nothing less than a fixed species. But when we have once accepted the notion that the corpuscles of the granular zone are the spores of the coccoliths, the appearance of many coccoliths is explained by it, as, for example, Pl. XVII. figs. 6, 10, and 14. In fact we often see, instead of the granular zone, which is elsewhere so distinct, an irregular ring or an empty disk-margin. For this I know no other explanation than that the granules have fallen out, leaving behind them that margin belonging to the medullar space from which the growth and production of the corpuscles of the granular zone took place. It is certainly remarkable that specimens such as Pl. XVII. fig. 14 are rare; but they show quite evidently a retrogression and degradation, which is expressed in the brittleness of the central disk and the shrinking of the dorsal shield. It will be objected that this is incompatible with the apparently uninterrupted accumulation of the coccoliths. But in opposition to this it may be said that the fossil coccoliths are still but very little investigated. The form with a finely granular zone (Pl. XVI.

fig. 15), which is so remarkably abundant among living coccoliths, I can hardly detect in the deposits at Brindisi; but it came most prominently into consideration with regard to reproduction. The objection is therefore not serious.

My supposition, however, as to the independence and reproduction of the coccoliths, is established by the discovery of a second corpuscle accompanying *Bathybius*, which is much simpler and clearer, and consequently easier to check in its individuality. It also presents certain points of comparison with the coccoliths. We call it *Rhabdolithes* (Pl. XVII. figs. 20–35). Its first foundation is a little rod, which may be traced of all sizes from 0·001 to 0·005 millim. The developed forms range between 0·0054 and 0·004 millim. in length. Together with the cylindrical rods there occur about an equal number which are thicker at one end than at the other (fig. 22). They then acquire a button-like or globular terminal inflation (figs. 21, 23); and around this is produced a circlet of globules (fig. 24 &c.) which rarely exceed six in number.

The usual form of the fully developed corpuscle is as shown in figs. 31 and 27, the parts of the circlet becoming cylindrical or bacillar; and one can hardly doubt that they are destined to be thrown off for reproduction. In their size and whole appearance they agree with the above-mentioned smallest bacillar corpuscles. Forms such as figs. 29 and 32 are more rare, and are produced, as we may ascertain by turning and twisting the object, by the portions of the circlet being pressed closer together. We may always distinguish in them the individual globular or bacillar parts when we succeed in placing the corpuscle upon the vertex which has no circlet. In the shaft of the larger and especially of the clavate specimens, we observe a fine streak, the indication of a central canal, as appears with certainty from cases such as fig. 30. Not unfrequently also we have forms such as fig. 26, in which the main outline is surrounded by a very pale external contour, and the appearance is produced as if the rod were a larger cavity. Figs. 33, 34, 35 show rare irregular structures. Thus in fig. 33 we see a sprout in the neighbourhood of the noncircleted end; in fig. 34 a piece of the circlet has been produced in the prolongation of the axis of the shaft; and in fig. 35 the circlet has been produced above its usual point of attachment.

In all the samples of mud from the Adriatic which contain *Bathybius* and the coccoliths, rhabdoliths also occur in countless quantities, so that a complete view of them may be obtained in almost every microscopic portion. They are just as well preserved as the coccoliths in the elevated deposits of

Brindisi; and their composition of an organic formation and of carbonate of lime may be demonstrated just as well as for the coccoliths. *Now, if we compare the granular zone of the coccoliths with the circlet of globules of the rhabdoliths, and the central disk (medullar space) of the coccoliths, as the matrix of the globules, with the shaft of the rhabdoliths, and consider that, as I believe I have shown, the dorsal disk or covering piece of the coccoliths is of but little importance, we must recognize the most intimate relationship between these calcareous organisms, notwithstanding their difference of form.* To regard the rhabdoliths as organs or form-constituents of the *Bathybius*-protoplasm we have not the least reason; and thus, it seems to me, the last doubt is removed, as to whether the coccoliths are independent creatures. The two bodies remain no less interesting than they did before, when the coccoliths passed merely as the tokens of the mysterious *Bathybius*. The origin and significance of this latter organic material are still far from being explained. As I have already indicated, it seems to me that the supposition that the *Bathybius*-protoplasm is the residue of other low organic creatures must be completely rejected. It is, however, no Protiston or Moneron in the signification now current, according to which all these simplest organisms have a limitation in space and a development. A living creature of unlimited extension is so strongly in contradiction to our present notions of life and organization, that our conceptions and ideas must first adapt themselves to it.

LI.—*Notice of a new Species of Lizard* (Eumeces albofasciolatus) *from North Australia.* By Dr. A. Günther, F.R.S.

The British Museum has recently received from Mr. Krefft a specimen of a very large species of *Eumeces* from Northern Australia, which appears to be undescribed and may be characterized thus:—

Eumeces albofasciolatus.

A supranasal shield is present, but on one side it is confluent with the nasal behind the nostril; the nostril itself is so large as to be partly formed by the supranasal.

The lower eyelid is scaly. Palate entirely toothless, the palatal notch being considerably behind the level of the orbit.

The single præfrontal forms a suture with the rostral and vertical, which is very long, as long as the occipitals together; a pair of anterior occipitals; central occipital elongate; occipitals bordered behind by four large scales. Nine upper labials, the two posterior low. Opening of the ear not denticulated.

Thirty-five longitudinal series of scales round the trunk; sixty transverse series between the fore and hind limbs. Ten præanals, scarcely larger than the neighbouring scales. Subcaudal scales scarcely larger than those on the back of the tail.

Limbs somewhat feeble; the fore legs extend to the eye when stretched forwards, the hind legs not quite halfway up towards the axil. The third and fourth fingers equal in length, but longer than the second. The third hind toe a little shorter than the fourth and a little longer than the fifth.

Upper and lateral parts blackish brown, with irregular bluish-white, band-like transverse spots, one or two scales broad. Tail and legs without such bands. Lower parts uniform white.

The specimen is 6½ inches long to the vent, the greater part of the tail being lost.

	in.	lin.
Distance of the snout from the eye	0	5
,, ,, ear	1	2
,, ,, axil	2	2
,, ,, vent	6	6
Length of fore limb	1	4½
,, third finger	0	3⅞
,, hind limb	2	0
,, second toe	0	4
,, third toe	0	6
,, fourth toe	0	6½
,, fifth toe	0	5

LII.—*Dredging-Excursion to Iceland in June and July* 1872.

By T. A. Verkrüzen.

Having relinquished my first idea of paying a second visit to Norway, where I had had an excursion last year of so much interest, I left London about the middle of June for Granton Harbour, Edinburgh, and went thence by the steamer 'Queen' to Reykjavik, where we arrived after a voyage of about ninety-five hours—perhaps the quickest passage made there, the wind being all the time in our favour. I stayed a month in the island, had a ride to the Geyser, besides several shorter excursions, and employed the remainder of my time in dredging and exploring the shores of the Bay of Reykjavik. I had considerable difficulty in obtaining good boatmen, the Icelanders not being accustomed to the labour of dredging, and tiring after a few hours of exertion. All circumstances considered, however, I managed, by good pay &c., to get my dredging done tolerably well; and encouraged by a friend to communicate the result of my labours to the conchological world, I now have much pleasure in doing so, trusting it may prove of some interest. I returned from Reykjavik towards the end of July, when our voyage back to Granton Harbour was performed in about five days and five nights, and took consequently nearly a day and a night longer than the outward passage. I much regretted my want of opportunity to visit likewise the more important northern part of that most interesting island, but should be happy to do so under favourable circumstances, as no doubt there we should meet with a decided, and perhaps highly interesting, arctic fauna.

My shells have been kindly verified by J. Gwyn Jeffreys, Esq., F.R.S., &c., who has obligingly assisted me in determining the species which had hitherto not come under my notice.

List of Mollusca

dredged and collected in the Bay of Reykjavik, Faxa Fjördur, Iceland, in 20 to 36 fathoms (ground mostly stony with sea-plants, in parts muddy sandy), in July 1872, by T. A. Verkrüzen.

1. *Anomia ephippium*, Linné. Small; from between roots of sea-plants.
2. —— ——, var. *squamula*, L. Small; from leaves of sea-plants.
3. *Pecten islandicus*, Müller. Not plentiful, and difficult to obtain.
4. *Mytilus edulis*, L. Abundant and common.
5. —— *modiolus*, L. Rather plentiful; occasionally very large.
6. —— ——, var. *ovata*, Jeffreys. Now and then met with.
7. *Modiolaria corrugata*, Stimpson. The young plentiful, adults rare.
8. —— *discors*, var. *semilævis*, Jeffr. (*lævigata*, Gray). A fine live specimen, though it got crushed in the dredge.
9. *Crenella decussata*, Montagu (*cicercula*, Möller). Abundant.
10. *Nucula tenuis*, Mont. Only five young specimens obtained.
11. *Leda pernula*, Müll. Moderately plentiful; large specimens and adults rarer.
12. *Axinus flexuosus*, Mont. Sparingly.
13. —— ——, var. *Gouldii*, Philippi. More plentiful.
14. *Cardium echinatum*, L. Rather scarce; adults of a thinner texture and smaller than British specimens.
15. —— *fasciatum*, Mont. Not common.
16. —— *islandicum*, L. Young and middle sizes pretty numerous, adults scarce.
17. —— *grönlandicum*, Chemnitz. Young and middle sizes pretty numerous, adults scarce.
18. *Cyprina islandica*, L. Not common in the bay.
19. *Astarte sulcata*, DaCosta, var. *elliptica*, Brown. Rather scarce: some approach the American variety of *undata*, Gould.

20. *Astarte compressa*, Mont. Abundant.
21. —— *borealis*, Ch. (*arctica*, Gray). Rather plentiful, though much scarcer than the last.
22. *Tellina calcaria*, Ch. Young and middle sizes abundant, fine adult specimens scarce.
23. *Mactra solida*, L. Scarce.
24. —— ——, var. *elliptica*, Brown. Similar to the last; a few more of these.
25. *Scrobicularia nitida*, Müll. Pretty abundant.
26. —— *prismatica*, Mont. A few amongst the last.
27. *Thracia truncata*, Br. About half a dozen obtained.
28. *Mya truncata*, L. Plenty of young, the adults only in odd valves.
29. *Saxicava rugosa*, L. Not common.
30. —— ——, var. *arctica*, L. A few among the last.
31. *Dentalium striolatum*, St. A few only obtained.
32. —— *entalis*, L., var. *infundibulum*, Lee. One dead specimen.
33. *Chiton albus*, L. Rather abundant.
34. —— *ruber* (Lowe), L. Middling plentiful.
35. —— *marmoreus*, Fabricius. Not scarce.
36. *Helcion pellucidum*, L. A few only obtained.
37. *Tectura testudinalis*, Müll. Plentiful and fine, my largest measuring about 1¼ inch (nearly 30 millims.) long.
38. —— ——, var. *pallida*, Verkrüzen. Colour white, all but the centre or dorsal scar, sometimes exhibiting a clouded wreath of a reddish-brown colour, or other ornamentation, in the inside, with a white margin, and sometimes a plain colouring, but *without* the longitudinal rays of the typical species. This variety also occurs in Norway; I am not aware whether it is likewise met with on the north British coasts; not finding it named, I have proposed the above designation for it.
39. —— *virginea*, Müll. Rather plentiful.
40. —— ——, var. *lactea*, Jeffreys. A few specimens.
41. *Lepeta cæca*, Müll. Not common. Rather a small form; the apex sharp and prominent.
42. *Punctura noachina*, L. Only two specimens, and a fragment of a third.
43. *Trochus tumidus*, Mont. Rather abundant.
44. —— *grönlandicus*, Ch. Of a fine rose colour, very beautiful; scarce.
45. —— *helicinus*, Fabr. Only one specimen got.
46. —— *cinereus*, Couthouy. One dead specimen, in good preservation.
47. *Mölleria* (Jeffr.) *costulata*, Möll. Rather scarce; mostly dead shells, a few with operculum.
48. *Lacuna divaricata*, Fabr. Pretty abundant.
49. —— ——, var. *canalis*, Mont. Similar to last.
50. *Littorina obtusata*, L., var. *palliata*, Say (=*limata*, Lovén). Common colours. Plentiful on sea-plants on the Eider-Duck Island in the bay.

—— ——, var. 1, darkest olive (nearly black). Abundant.

Littorina obtusata, var. 2, middle olive. Similar to last.

—— ——, var. 3, light olive. Not quite so plentiful.

—— ——, var. 4, yellow. Scarce.

The olive varieties have purple or plum-coloured throats; the yellow varieties have yellow throats.

—— ——, var. 5, banded, various colours. Not common.

—— ——, var. 6, chequered. Similar to the last.

—— ——, var. 7, mottled. More plentiful among the common colours, though prettily mottled or clouded specimens are scarce.

51. —— *rudis*, Maton. Common colours. Abundant.

—— ——, var. 1, grey. Less common, especially fine examples.

—— ——, var. 2, white, brown throats. Plentiful, though fine specimens rather rarer.

—— ——, var. 3, cream, orange throats. Rather scarce.

—— ——, var. 4, red. Now and then occurring.

—— ——, var. 5, ribbed. Same as the last, amongst any of the varieties and type.

—— ——, var. 6, grey-and-white banded. Plentiful; fine specimens scarcer.

—— ——, var. 7, coloured-banded. Not frequently occurring.

—— ——, var. 8, chequered. Not frequently occurring.

—— ——, var. 9, mottled. Not frequently occurring.

52. *Rissoa striata*, J. Adams. Perhaps about two dozen obtained, mostly dead shells.

53. *Skenea planorbis*, Fabr. Two specimens.

54. *Odostomia insculpta*, Mont. Fewer than *Rissoa striata*.

55. —— *unidentata*, Mont. Only one obtained, a dead shell.

56. *Natica islandica*, Gmelin. A few only (dead shells) washed on shore.

57. —— *grönlandica* (Beck), Möll. Young and middle sizes pretty plentiful, adults scarce.

58. —— *affinis*, Gm. (*clausa*, Sowerby). Similar to the last, perhaps rather scarcer.

59. *Velutina lævigata*, Pennant. A few only obtained.

60. *Trichotropis borealis*, Broderip & Sowerby. Like the last; some fine specimens.

61. *Admete viridula*, Fabr. About twenty dredged; mostly fine specimens, my largest about 17 millims. long and 9 wide.

62. *Aporrhais pes-pelecani*, L. A fragment (the spire) of one adult, and four young.

63. *Purpura lapillus*, L. Common colours, plain. Very abundant on piers and rocks.

64. —— ——, var. 1, orange-colour. Occasionally met with among the last.

65. —— ——, var. 2, banded. Same as last.

66. —— ——, var. 3, ribbed. Occasionally amongst any of the preceding.

67. —— ——, var. 4, *imbricata*, Lamarck. Rare, especially the fine specimens.

68. *Buccinum undatum*, L. Shape similar to British; spire rather longer in proportion, waves and spiral ribs rather coarse and strongly produced. All of these were dredged in deep water.

69. —— ——, var. *planum*, Verkr. Shape conical, spire shorter than in typical form; mouth proportionally longer; whorls flatter; suture shallow; waves slight and disappearing on last whorl, sometimes on the two or three last; spiral ribs indistinct, except on intermediate forms; texture thin and more brittle, plain; colour a purplish olive-grey, with dark purplish-brown throat, the intermediate forms generally of a lighter hue. This variety occurred in one to four feet water at lowest ebb-tide, near the shore; none of these were dredged in deep water.

70. *Trophon truncatus*, Ström. Rather scarce.

71. —— *clathratus*, L. Similar to the last, though more frequently met with.

72. —— ——, var. *Gunneri*, Lov. This form occurs perhaps the most of the three, though all are rather scarce.

73. *Fusus despectus*, L., var. *tornata*, Gould. Only three dredged.

74. *Pleurotoma turricula*, Mont. Not common; fine specimens; my largest 21 millims. (nearly ⅞ inch) long, and 11 millims. (nearly ½ inch) wide.

75. —— *Trevelyana*, Turton. A few only obtained.

76. —— *pyramidalis*, Str. More frequent, still rather scarce; fine specimens rare.

77. —— *violacea*, Mighels & C. B. Adams. Young rather plentiful, the older ones not frequent.

78. —— *bicarinata*, Couthouy. About half a dozen young shells got, mostly dead.

79. *Utriculus Gouldii*, Couthouy. Pretty plentiful, though mostly dead shells.

80. —— *hyalinus*, Turton. Only three specimens obtained.

81. *Actæon tornatilis*, L. One young dead specimen.

82. *Philine scabra*, Müll. A few specimens only.

83. *Doris bilamellata*, L. Four pretty specimens from under a stone at low water.

Conspicuous by their absence in the places where I dredged and collected were:—Brachiopoda, *Pecten* (except *islandicus*), *Lucina borealis*, *Cardium edule*, *Dentalium entalis* and others, *Patella vulgata*, *Littorina littorea*, and other species so frequently met with in Norway and on other northern coasts, though I doubt not but some of them will occur in other parts of Iceland.

Should any one have a wish to inspect my Icelandic collection, I shall be happy to show the same on receiving a previous intimation, for the purpose of arranging the time.

The following circumstance may, I trust, not be without interest to collecting conchologists. One morning the boy I had engaged brought me several *Patellæ*, which genus I had not met with near Reykjavik, and one thick *Purpura lapillus*, different from those I had found in great numbers. He spoke but very little Danish, and it was with difficulty I got to understand from him that he had obtained them from a ship. Going there with him, I saw them unloading sand brought as ballast from Great Britain. It was fortunate I found this out, as I might otherwise have taken them for Icelandic shells from a different part of the island. This is one more instance showing how shells may be transported to countries where they do not occur in a living state, thus causing errors against which conchologists cannot be too much on their guard.

2 Ampton Place, W.C.

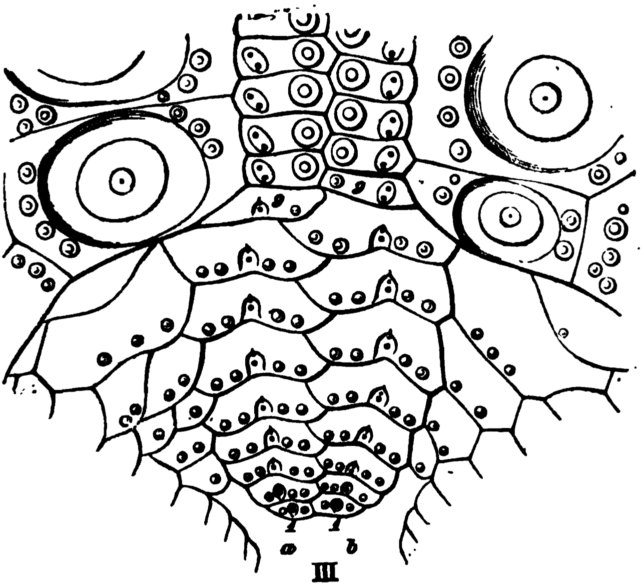
LIII.—*On the Structure of the Echinoidea.* By S. Lovén.

[Continued from p. 298.]

The explanation just given of the development and changes of the ambulacra in the Latistellæ shows that during the growth of the *Echinus* the primary plates of both rows, as if borne by a slowly flowing stream, are in motion from the point near the eye-plates where they make their appearance, as from its source, down towards the peristome. There the auricles meet, which belong to the masticatory apparatus, not to the corona, with their bases firmly attached to the inside of the oldest plates. It is by their resistance that, in the Latistellæ, the peristome becomes the fixed boundary of the corona towards the buccal membrane, and that, during their growth and the simultaneous downward pressure of the primary plates, the pressure originates of which the consequences are the regular displacement, shifting, and firm coalescence of the plates, which renders the position of the pores apparently confused.

The Angustistellæ, or Cidaridæ, present different conditions. In them all the primary plates of the ambulacra are entire plates, continue so always, and distinctly separated from each other by sutures, which are not effaced by any coalescence. They are consequently throughout life like the primary plates in the young of the Latistellæ in their first foundation, and form a narrow, single, and uninterrupted sequence, of nearly the same width, which descends gradually in the direction of the margin of the corona, between the margins of the large interradial plates, with regular flexures, which are not original curves, but determined by the margins of the interradial plates. There the bases of the auricles present no resistance; they remain entirely upon the interradia, by the side of the track of the ambulacra, which they leave so open that there is no obstacle to cause compression or enlargement in width. On the contrary, when a primary plate in the ambulacrum reaches the margin of the corona, the suture which previously united it with the next following plate separates, it becomes free, and it moves out into the buccal membrane as if out of the mouth of a river (fig. 2). At the same time a change takes place in its form. The curved process on the inside of each plate, which is more elevated the nearer we approach the peristome, is absorbed when the plate separates, and disappears quickly. The plate wears away at its lower margin, and its radiolar tubercle diminishes; but it increases greatly in breadth towards the interradium, and also in depth, and thus becomes attenuated into a lamella, or scale, which lies with its lower margin over its predecessor. The pores thus come gradually to be situated lower and lower, become drawn out transversely, and change their position relative to the longitudinal axis. In the rows of scales produced in this manner in the buccal membrane of the Cidaridæ, the pair which most closely approach the mouth are the oldest plates, the others, each in its order, have separated themselves from the corona, and gradually increased the number of lamellæ in each row.

Fig. 2.



Cidaris hystrix, third ambulacrum: the ninth plate in *b* has scarcely separated; its fellow in *a* is already free and converted into a lamella.

The great distinction between the Cidaridæ and the Latistellæ consists in this dissimilar movement of the ambulacra. Thus, in the former, the ambulacrum breaks up at the peristome into its elements, the primary plates, and these become converted into free imbricated lamellæ; and this is in complete opposition to the homologous movement which, in the Latistellæ, concludes with their union into large plates, which in the peristome coalesce into a solid ring. And nevertheless the same law prevails here most distinctly as in all other Echinoidea. A careful examination shows that, of the oldest scales (which immediately surround the mouth), those which belong to series I. *a*, II. *a*, III. *b*, IV. *a*, V. *b* are somewhat smaller than those which constitute series I. *b*, II. *b*, III. *a*, IV. *b*, V. *a*. If we trace the rows upwards towards the corona, we find that the former throughout cover the latter with their lateral margins; and when we come to the corona we see that this position of theirs is due to the fact that the plates of the former series come later to the margin, and do not begin to separate until after their fellows of the latter series are already completely free and begin to arrange themselves in the imbricated rows of the buccal membrane; and this difference is to be recognized throughout the whole ambulacrum. Of each pair of plates, that which belongs to the series I. *a*–V. *b* follows that of the series I. *b*–V. *a*; and of the newly formed pair close to the eye-plate, the plate belonging to the former series is always less developed than that of the latter series, or even still uncommenced. In a *Cidaris hystrix* of 28 millims. diameter the number of plates from the mouth to the vertex is as follows:—

in I. *a*	54	in I. *b*	55
„ II. *a*	54⅔	„ II. *b*	55½
„ III. *b*	54	„ III. *a*	54½
„ IV. *a*	56	„ IV. *b*	56½
„ V. *b*	56	„ V. *a*	56½

If we compare with the Latistellæ the different groups of irregular Echinoidea, *Echinoneus* comes nearest to them in the structure of the ambulacra. All the pores are double pores. As in the Spatangidæ and the Cassidulidæ, the peristomial plates of series I. *a*–V. *b* have two pores (that is to say, they consist hypothetically of two early coalescent primary plates), and those of the series I. *b*–V. *a* only of one; and in the former the lowest pore is marginal and broken, and frequently has its upper tube obliterated, as in the Echinidæ. But the buccal membrane is without pore-plates. Although the row of pores is simple, entire and half plates alternate with each other in regular order, which does not continue the same from the vertex to the peristome. The newly formed plates are entire; then they arrange themselves in groups of three, two half aboral and an entire adoral. Gradually the upper aboral plate increases and becomes entire, and, together with the adoral plate, embraces the intermediate half plate. But these groups do not unite into large plates in the neighbourhood of the peristome by the coalescence of the sutures as in the Latistellæ. *Echinoneus* again agrees with the latter in that the alteration of the plates, which is a consequence of their growth during the accession of new ones from above, takes place in a uniform manner throughout the whole ambulacrum, which, moreover, throughout, from the peristome to the vertex, bears no other than cylindrical tentacles with sucking-disks, in which there is a ring of calcareous network. This is not the case in the other three groups of irregular Echinoidea, in which the branchiæ have a portion (in the Cassidulidæ and Clypeastridæ in all the five ambulacra, in the Spatangidæ in most cases in the four paired ones)—a portion which during growth acquires the leaf-like form to which the name of *petalum* is given, whilst the lateral plates nearly retain their first form, and the buccal area, with its peculiar tentacles, is gradually compressed and altered. While in the Echinidæ and Clypeastridæ the peristome in its firm union with the masticatory apparatus continues circular or five-cornered as it was from the beginning, although in some (*e. g. Echinometra* or *Echinocidaris*) it deviates therefrom with age in some degree, its character in the Cassidulidæ and Spatangidæ, which do not possess a masticatory apparatus, is quite different. In both it alters its form during growth; how it may be in *Echinoneus* remains to be ascertained. When a *Cassidulus* is still quite young, the peristome is pentagonal, with rounded angles, and the ambulacra occupy larger portions of its margin than the interradia, with the exception of the labrum; in full-grown examples the conditions are reversed, inasmuch as the interradial peristomial plates, especially in 2 and 3, become swelled up during growth, and give the pentagon the incurved sides which are characteristic of this group, and between which the first plates of the ambulacra, compressed into a wedge-shape, enclose the projecting angles. But the mouth, gradually elongated transversely, remains in the middle of its naked membrane. Connected with this transformation of the peristome are the compression and displacement of the primary plates situated near the peristome (which take place with age), and that considerable alteration of their original relations by which that arrangement is produced which Desor calls *phyllode*. We have still to investigate the origin and progress of this in individuals of different ages.

Of the living Spatangidæ, by far the greatest number have the four paired ambulacra like each other in closing with petala towards the vertex, whilst the unpaired anterior ambulacrum has its peculiar structure, and in one genus, *Echinocardium*, even the alternation of entire and half plates, which does not occur elsewhere in this family. Not more than two genera can be found which form an exception to this: one of them is *Lissonotus fragilis*, A. Agass., from the great depths between Cuba and Florida; the other was discovered by Smitt and Ljungman during the expedition of the corvette 'Josephine' in the year 1869, off Villa Franca, in the Azores, at a depth of 200–300 fathoms. A resemblance which this Spatangid presents at the first glance from above to certain forms of *Ananchytes ovata*, leads us to name it *Palæotropus*; the species may be called *P. Josephinæ*. All five ambulacra lie in the plane of the test, without the slightest depression, and are apetalous; so that they all finish similarly towards the vertex—in this way, that their five or six youngest plates form a simple and narrow row, such as we see nowhere else, in which, however, the alternating position of the pores indicates to which side each plate is to be referred. The rows of the trivium agree completely; the unpaired one is not depressed, and the dorsal arching of the test is uniformly within the obovate circumference. These characters differ greatly from those of the living Spatangidæ; others agree with them. The mouth has a projecting lobe, and the somewhat depressed posterior end of the test an infraanal fasciola. The genital apertures are two in number, corresponding to the posterior paired interradia 1 and 4. The eye-plates are very distinct; but the vertical plates cannot be distinguished; the right anterior one, however, has a bounded, irregular orifice, which is the madreporite. The length of the animal described is 11·7 millims., and its breadth 9·1 millims. The presence of a fasciola and a developed labrum unites *Palæotropus* with the Spatangidæ, if we exclude from their character the petala and the difference of the unpaired frontal ambulacrum from the rest.

There is no living Spatangid destitute of tentacular pores in any of the plates of the frontal ambulacrum. In all, its oldest ventral plates, within the buccal area, are like those of the other ambulacra; and the younger ones, situated nearer the vertex, have more or less distinct double pores, the elongated apertures being closed in the middle by a portion growing out from the margins.

Because the Spatangidæ in general do not grow to an equal extent in the different radii, but most frequently more in the direction of the bivium than of the trivium, their ambulacral plates, which, except the peristomial ones I. *a*–V. *b*, are always simple and primary, behave in a different manner. As in all the irregular Echinoidea, the corona has a fixed boundary in the peristome. Many young Spatangidæ a few millimetres in length, which are more rounded than the older ones, and have the mouth nearer the middle, have the peristome pentagonal, and so nearly equilateral, that in a still earlier stage it was probably completely so (see woodcut, fig. 3). Its sides all lie in the plane of the test, or are just sunk within it, as in *Hemiaster* &c. In accordance with this form of the peristome, is the part taken in its formation by the ambulacra and interradia. In opposition to what occurs in *Cassidulus*, the former occupy only a small portion, enclosing the angles of the peristome; the latter, which are much broader, and nearly of equal breadth among themselves, form the greatest parts of its sides. The mouth is now in the middle of the buccal membrane. The considerable change which the peristome subsequently undergoes consists in its ambulacral plates increasing in breadth, especially in the trivium, whilst the peristomial plates of the paired interradia do not increase in breadth in the same proportion, especially those of the posterior pair; and that of the unpaired interradium (the labrum) becomes widened, shoots forth, and arches itself, at the same time that the mouth, having become elongated by degrees, gradually moves backward, so that the greater part of the plated buccal membrane soon comes to lie in front of it, and only a narrow border behind it, and this is concealed by the projecting lobes. When the individual is full-grown the ambulacra of the trivium near the peristome are broader than the interradia, with the exception of the labrum; in *Breynia* the peristomial plates of the paired interradia 2 and 3, 1 and 4, are even entirely expelled from the peristome, and in *Atrapus grandis*, *Mœra atropos*, and *Micraster cor-anguinum* those of the pair 1 and 4. It is especially the paired ambulacra of the trivium II. and IV., of which the peristomial plates, longer than broad and nearly wedge-shaped in the young, in old examples are broader than long, and so depressed that, while in small individuals of *Brissopsis lyrifera* 4·6 millims. in length the anterior margins of the peristomial plates in the interradia 1 and 4 regularly correspond to two plates in the ambulacra II. and IV., they receive three plates in older individuals. Thus here also a movement takes place in the ambulacra towards the peristome, between the interradia. It is only a little less in degree in the unpaired ambulacrum. In the bivium it is otherwise. Here it is the two oldest plates that are the most pressed; the following ones, even in the older individuals, preserve their elongated form. A different condition stands in connexion with this. Most of the living genera of Spatangidæ have an infraanal fasciola, which forms below the periproctium an oval ring, within which, as Johannes Müller first observed in *Brissopsis lyrifera*, long tentacular cirri come forth, the pores of which, therefore, are also situated within its circumference. At the same time the case is that, in all the genera furnished with an infraanal fasciola, in both the inner rows of the bivium the sixth plate and some of the following ones—namely, two in *Palæotropus*, *Spatangus*, and *Meoma* (which has an incomplete fasciola), three in *Maretia*, *Echinocardium*, *Lovenia*, *Brissopsis*, and *Eupatagus*, four in *Brissus*, *Kleinia*, *Plagionotus*, and *Xanthobrissus*, and even six in *Breynia*—have a different form from the others, inasmuch as they are drawn out towards the middle line of the test, and form together a produced wedge. In the seventh and following of these plates, moreover, the tentacular pore has so shifted that it comes within the fasciola. In all these genera it is also the rule that the first six plates of the inner rows of the bivium correspond with the outer margins of the labrum, sternum, and episternum, the three ventral parts of the unpaired interradium, and that the episternal pair of plates forms, with the nearest pair of abdominal plates on both sides, an angle (*angulus episternalis*) which receives this wedge of produced plates, and in different genera is more or less deep or open. A young *Brissopsis lyrifera*, 4·6 millims. in length, presents in these respects the same characters as the full-grown individuals; in both it is the fifth ambulacral plate that corresponds to the angle between the sternum and episternum, and the sixth to and with the ninth that enter the episternal angle; and hence it is clear that in this part of the bivium during growth no shifting takes place in these plates in the direction of the peristome; but we rather see the ambulacral plates here, except those of the peristome, become somewhat elongated with age. In the genera which are destitute of a *fasciola infraanalis* (such as *Schizaster fragilis*, *Desoria*, *Agassizia*, *Abatus*, *Atrapus*, and *Hemiaster*) the plates corresponding to the scarcely perceptible *angulus episternalis*, which is not always alike on both sides, are but little or not at all produced in a direction towards the middle line of the test, but have almost completely the form of the preceding; and the number of plates of the bivium which occupy the same length as the three ventral parts of the unpaired interradium is indeterminate,—in *Schizaster* seven, in *Atrapus* six, in *Abatus* seven and a half on the left side and six and a half on the right, in *Desoria* eight and a half, in *Agassizia* six and a half. This irregularity is most considerable in

Palæostoma, Gray, at least in young individuals; I have no full-grown ones at my disposal. In the whole of this group consequently the arrangement, especially in the interradia, is much less strict and symmetrical than in those with infraanal fasciolæ. These latter seem to prevail among the recent Spatangidæ, but were apparently represented only in the genus *Micraster* during the Cretaceous period, the other genera of which either want the fasciola or have it peripetalous or composite, and with this, we may assume, a less regular arrangement of the plates.

A strongly depressed form of body, the proximity of the two surfaces (ventral and dorsal) to each other, their union internally by means of processes, pillars, arches, and chambers, the distribution of the very numerous tentacular pores even upon the interradia, the madreporite, which, in most, occupies all the five apical plates, the position of the genital pores not always in the apical plates, but separate from them in the interradia—all these are characters which, with others, distinguish the Clypeastridæ from the other irregular Echinoidea. On another side they approach the regular Echinoidea by the presence of jaws, by the small alterability in form of the peristome during growth, which is dependent upon this, and its central position in the ventral surface, opposite to the pentagon of the vertical and eye-plates in the dorsal surface, in which only the abnormal *Dendraster* and some few others present any deviation. When full-grown, moreover, they have, in many genera, all the five ambulacra alike; whilst in others the bivium, to a certain extent, becomes apparent early, or gradually, by the movements and changes in the form and size of the plates, which are more considerable here during growth than in other Echinoidea. L. Agassiz and Johannes Müller observed how, in the Clypeastridæ, the corona simplifies itself towards the mouth, how the plates increase more in breadth than in length (as had already been noticed by Philippi in *Echinus*), and how this applies most to the ambulacral plates, which are inserted into each other.

In the fully developed state *Echinocyamus pusillus* and *Laganum depressum*, both of which have all the five interradia connected in an uninterrupted sequence of plates, are regular, with all the five ambulacra similar, and, with the exception of the periproctium, essentially also all the interradia—as also *Encope Valenciennesi* and *E. Stokesi*, *Clypeaster rosaceus* and *Stolonoclypus prostratus*, in which, in all the ambulacra of both bivium and trivium, plate 2 in the former and plates 2 and 3 in the latter are so enlarged in breadth that by means of them, in their outer angles, all the ambulacra touch each other, form a complete circle, and shut off plate 2 and the following ones of the interradia from plate 1, which takes part in the formation of the peristome, which here, as in all these genera, is complete, *i. e.* composed of ten ambulacral plates and five interradial plates.

Irregular forms, with a bivium which differs from the trivium, are *Mellita* (*hexapora*) and *Rotula* (*Rumphii*), in which plates 2 in I. *a* and V. *b* become enlarged inwards, and therefore do not interrupt the unpaired interradium, of which the sequence of plates is continuous; whilst the former in the trivium and in I. *b* and V. *a* has plates 2 and 3, and the latter plate 2 in the trivium and plates 2 and 3 in I. *b*. and V. *a*, so dilated that they form a ring which is open only at the unpaired interradium, and by which the sequence of plates in the four paired interradia is interrupted and in each of them peristomial plate 1 separated from the following ones. *Echinarachnius parma* and *Lobophora* are irregular in a contrary way; in them plates 2 in I. *a* and V. *b* are more dilated than those in the trivium and in I. *b* and V. *a*, so that the unpaired interradium is interrupted in a much greater degree than the paired ones. All these also have the peristome complete, composed of ten ambulacral and five interradial plates. *Arachnoides* is singular in having the oldest ambulacral plates so strongly dilated in breadth that in all five interradia plate 1 has disappeared from the peristome, which consists only of the ten first ambulacral plates, forming with the two or three following ones a broad connected ring, which throws the interradia far away. But even here the bivium makes itself felt, although in a small degree. Between plates 2 in I. *a* and V. *b* there is a little space left open for two very small and compressed plates of the unpaired interradium.

Thus, whilst in the Echinidæ, *Echinoneus*, and the Cassidulidæ the test is still nearly regular and regularly divided into ambulacra and interradia, and in the Spatangidæ the former only rarely predominate so as to displace the latter from the peristome, in the Clypeastridæ the preponderance of the ambulacra is the rule, and in most of them the interradia are therefore interrupted. It is of importance to ascertain whether these peculiarities pertain to the earliest ages or make their appearance during growth.

A *Mellita hexapora* 6·5 millims. long has great distance between the rows I. *a* and V. *b*, so that the interradium between them lies free and broader than in the others; but plates 2 in I. *b* and V. *a* of the bivium and in the whole of the trivium have already become so widened that they form a connected circle which excludes the following plates from the peristomial interradial plate 1. It is, however, only at a still larger size that plate 2 also is so dilated that it enters into this circle; and this increase indicates that when of a less size than 6·5 millims. *Mellita* may have all its ambulacra separate. This is actually the case in *Echinarachnius parma*. A young individual of this species, 6·5 millims. in length, has all five ambulacra similar; and their plates 2 are not yet broad enough to affect the form of the interradia, all of which are free and connected in uninterrupted sequence. But at a length of 34 millims. plates 2 of I. *a* and V. *b* in the bivium have so increased as to touch each other and interrupt the unpaired interradium, although one of the plates 2 is excluded from contact with plate 1 still only in interradia 1 and 4. It follows from this that the regular form, with five similar ambulacra and five similar interradia, is the primordial one in the Clypeastridæ, which is retained by *Echinocyamus* and *Laganum*, but from which *Encope*, *Clypeaster*, and *Stolonoclypus*, *Mellita* and *Rotula*, *Echinarachnius* and *Lobophora*, together with *Arachnoides*, depart during growth, the five last named, moreover, forming a bivium. Pressure towards the peristome during growth and the addition and great multiplication of new plates in the petala which are destined for the branchiæ have a great part in these changes. The "equator" is not the same during the whole life of the animal. We may see, by comparing several *Echinarachnii* of different ages, how a great part of the plate through which the periphery passes gradually goes over to the ventral surface, until the following one becomes visible there, and the periproctium, which is at first dorsal, becomes finally more than half ventral. At the same time the stoma of the test, as in the *Echini*, becomes less in proportion to the whole animal. In a *Mellita hexapora* 6 millims. broad the transverse diameter of the stoma is about 0·13 of that of the disk, at 8 millims. 0·1, at 35 millims. 0·04, and at 80 millims. 0·034.

[To be continued.]

LIV.—*Contributions to the History of the Hydroida.* By the Rev. THOMAS HINCKS, B.A., F.R.S.

I. *The Sarcothecæ (Nematophores) of the* Plumulariidæ.

[Plate XX. figs. 1–8'.]

THE singular organs to which the name *nematophore* has been assigned by Busk, and which are confined to the Hydroid family of the Plumulariidæ, have been investigated by several able observers; and much light has been thrown on their structural and physiological history, though as yet little is known of their precise function. Meneghini seems to have been the first to notice them; he was followed by Huxley (1849); and a few years later Busk gave a more complete and accurate account of them, and drew special attention to the important characters which they yield to the systematist. Allman (1864) studied the contents of the nematophore, and established the very interesting fact that the soft granular mass contained in it has the power of emitting extensile processes, very similar in structure and behaviour to the "pseudopodia" of an *Amœba*. More recently (1872) Kirchenpauer has minutely described the varieties of nematophore which occur in the different groups of Plumulariidæ, and has applied the results of his research in a revised arrangement of the family*. After all, however, one or two points have escaped observation which are worthy of record.

The presence of thread-cells in the protoplasm of the nematophore has been noticed by Busk and Allman. They seem not to occur universally; at least the latter observer failed to detect them in *Antennularia antennina*, Linn. In all the species which I have examined they are present, and occupy the same position.

It has been observed that these thread-cells are never carried out in the "pseudopodia"—a remark which indicates that the true structure of the protoplasmic offshoot enclosed in the chitinous case of the nematophore has not been determined. In all the cases that have come under my notice the terminal portion of the sarcode-mass was divided into two distinct and constant lobes, in one of which (the superior) the cluster of thread-cells was immersed, while from the other (the inferior) originated the extensile process.

In the nematophores which stand out on each side of the calycle in *Aglaophenia pluma* this bipartite structure may be studied to great advantage. The superior lobe (Pl. XX. fig. 1, *a*) is elongate in form, and extends from about the middle of the cavity to the outer extremity of the terminal aperture; it contains a number of rather large thread-cells, arranged longitudinally at the very summit. The inferior lobe, which originates at the base of the other, presents a rounded outline (Pl. XX. fig. 1, *b*) when at rest, and is composed of a simple granular substance.

In *Plumularia setacea* (Pl. XX. fig. 2) the bilobate character is equally marked, though, from the nature of the chitinous cup or bowl in which the nematophore terminates, the two lobes are more nearly on a level than in the previous species. At the same time the portion containing the thread-cells stands out as a well-rounded prominence above the margin of the cup, while the extensile lobe originates at one side of it, a little below the summit. I have observed the same structure in *Plumularia pinnata.*

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* 'Ueber die Hydroidenfamilie Plumularidæ, einzelne Gruppen derselben und ihre Fruchtbehälter.' Hamburg, 1872.

The division of the sarcode-mass towards its upper extremity into two processes with different functions is very apparent in the mesial nematophore, which adheres to the *front* of the calycle in *Aglaophenia pluma.* In this case the chitinous tube of the nematophore is not merely furnished with a terminal aperture, but also communicates with the cavity of the calycle to which it is attached. The lobe bearing the thread-cells extends to the top of the tube; the extensile (or inferior) lobe only to the point where this communication exists, and here it discharges itself into the calycle, as noticed by Allman, who does not seem, however, to have recognized the constant diversity of function in the two branches of the granular mass.

Kirchenpauer has described certain species of *Aglaophenia* in which the tube of the anterior nematophore has a second orifice, placed generally near the point at which it begins to stand off from the calycle; this orifice does not communicate with the cavity of the hydrotheca, but affords a passage for the extensile lobe into the surrounding water. He proposes to designate nematophores of this kind "double-mouthed" (*zweimündige*). This observer does not seem to have noticed the bilobate structure of the lateral nematophores, which I have just described.

We may distinguish, then, in the nematophore:—(1) the chitinous case, which may be simple (Pl. XX. fig. 1) or compound (fig. 2), and, if simple, furnished with one orifice only or with two; and (2) the soft granular offshoot from the ectoderm pervading it, which may be either entire and destitute of terminal thread-cells, or divided into two lobes above, one bearing thread-cells and the other extensile.

The protoplasmic processes which are emitted by the inferior lobe have been well described by Allman. They are very mutable, and exhibit frequent changes of form, often attaining a great length. Sometimes they are cylindrical and slender, stretching along the stems and branches, to which they are closely appressed and along which they glide slowly, almost imperceptibly, in *Amœba*-like fashion; sometimes they appear clavate at the extremity; sometimes they swell out at intervals into bulbous dilatations. Occasionally they may be seen to reach across to a neighbouring branch and fix the extremity upon that; and rarely they give off two branches at the top, which move in opposite directions (Pl. XX. fig. 3, *b*). I have observed them in a state of great activity, as I have mentioned elsewhere, on a young specimen of *Plumularia frutescens*, which they completely invested with "a multitude of gossamer-like threads." These extraordinary prolongations of the granular mass in the nematophore can be entirely withdrawn.

The action of the thread-cells on the superior lobe is much more rarely witnessed; Meneghini seems to have noticed it, but without comprehending its true nature. On a specimen of *Aglaophenia pluma* I have seen the contents of the nematocysts discharged, and the long delicate threads streaming upwards from the extremity of the lateral nematophores (Pl. XX. fig. 1, *a*). These fine extensile lines were cast out to enormous distances, intertwining and waving about in the water; three or four were usually emitted from each cluster of thread-cells; and in some cases I noticed that the cyst itself was raised to some height above the nematophore and borne on a slender pedicle. At times a tuft of the threads might be seen slowly contracting, and I have observed one dragging down with it a mass of stuff which it had collected.

The sight of this wonderful apparatus in full action was singularly interesting, and it was impossible not to feel that it must bear some important relation to the life of the Hydroid. I may mention that the specimen on which the thread-cells were in action showed no trace of pseudopodia.

It is difficult to form a conjecture as to the function of these curious appendages. They have been regarded as organs of defence; and Kirchenpauer proposes to rank them with the polypites and gonozooids of the Hydroid colony under the name of the "defensive zooids" (*Wehrthiere*). But it seems to me very doubtful whether this is the true interpretation of the nematophore. I am inclined to think that its function may be in great measure nutritive; the pseudopodia at least seem much better fitted for the work of alimentation than for that of defence.

If we may accept Prof. Allman's very ingenious theory of the structure of the fossil Graptolites, we shall have important evidence in favour of this view. He regards them as morphologically Plumulariidans in which the development of hydrothecæ has been suppressed by the great development of the nematophores*. In short, according to his interpretation, they were Plumulariidans in which the ordinary alimentary zooid (the polypite) was wanting, and the function of nutrition probably devolved altogether on the nematophores. If this view be correct we shall have, as Allman has remarked, in the nematophore of the existing *Plumularia* "the last traces of the structure of its ancient representative, the Graptolite."

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* 'Monograph of the Gymnoblastic or Tubularian Hydroids,' part ii. p. 170.

In this case we must conceive of the remote ancestors of our recent forms as obtaining their food altogether after the manner of a Rhizopod, by help of the pseudopodia, which still survive to supplement the work of the polypite. This view, however, though ably supported, can hardly claim at present to be more than a happy conjecture.

A word as to the terms employed in this department of Hydroid morphology. With our present knowledge, *nematophore* can scarcely be accounted an appropriate designation for these singular appendages. The presence of thread-cells is certainly not the most significant or distinctive character which they exhibit; and it would seem that it is not universal. As we have already the terms *hydrothecæ* and *gonothecæ*, I should propose to name them *sarcothecæ*, while the offshoot from the ectoderm, which they enclose, may be appropriately called the *sarcostyle*.

II. *New Species of* Plumularia (P. cornu-copiæ, *Hincks*).

[Plate XXI. figs. 1–3.]

I have lately obtained at Ilfracombe a new *Plumularia*, which exhibits some interesting points of structure. In the form of the calycle, the jointing of the stem and branches, and the general arrangement of the sarcothecæ (nematophores) it resembles *P. Catharina*, Johnston; but from this species it differs notably in size and habit, in the form of the gonothecæ, and in the alternate arrangement of the ramules. It is remarkable, however, that while the pinnæ are usually alternate and somewhat widely separated, one or two of the lowest pairs are not unfrequently opposite, as in *P. Catharina*. Another distinction between the two forms is to be found in the structure of the sarcothecæ that occur one on each side of the calycle; in *P. Catharina* they are pedunculate, in the present species sessile. Looking at the whole assemblage of differences and points of resemblance, it seems not improbable that we may have in *P. cornu-copiæ* a derivative from *P. Catharina*, though it is now a strongly marked and well-established form.

Fam. **Plumulariidæ.**

Genus Plumularia, Lamarck (in part.).

P. cornu-copiæ, n. sp.

Plumes distributed at intervals on the creeping stolon. *Stems* recurved, regularly jointed; a single internode between those which bear the ramules. *Pinnæ* generally alternate, occasionally opposite towards the base of the plume, simple, moderately distant, a single calycle on the main stem at their origin. *Hydrothecæ* cup-shaped, deep, with an even margin, separated by two joints. *Sarcothecæ* bithalamic, one on each side of the calycle above and one below it, two on the intermediate internodes of the stem and one on those of the pinnæ, and two on the longer internode near their base. *Gonothecæ* shortly pedunculate, springing singly or in pairs from the base of the calycles both on the stem and pinnæ: female in the shape of an inverted horn, curved inwards towards the calycle; aperture suboval, oblique; two sarcothecæ near the base: male unknown.

Height of plumes about ¾ inch.

Hab. On stones, dredged off the Capstone at Ilfracombe.

The plumes of *P. cornu-copiæ* are compact and slightly recurved. The pinnæ are not very distant, and of moderate length, seldom bearing more than six calycles; I have never seen them branched. The internodes which separate the hydrothecæ are not nearly so long as in *P. Catharina*, and bear only one sarcotheca, whereas there are two or three in the latter species. The much greater length of the internodes, both on the stem and branches, in *P. Catharina* confers on this species a very distinctive habit. It approaches *P. cornu-copiæ* in many of the details of its structure, but not at all in general appearance. The pinnæ of the latter species are decidedly alternate, with the exception I have mentioned above. The most striking feature undoubtedly is to be found in the gonothecæ, the peculiar form of which has suggested the specific name*. They originate, as in *P. Catharina*, at the base of the calycles, sometimes singly, but frequently in pairs, and are perfectly hyaline and of the most delicate texture; they are of ample size and most gracefully curved, bearing, like the similar parts in the allied species, two of the bithalamic sarcothecæ near the base. The polypites are adorned, just below the tentacles, with a conspicuous belt of opaque white, which forms a striking feature.

III. *Reproduction by Fission in* Campanularia neglecta, *Alder.*

[Plate XX. fig. 4.]

Allman has described a case of reproduction by spontaneous fission in a Campanularian Hydroid which he has referred to a new genus under the name of *Schizocladium*†. I have had the opportunity of observing the same mode of development in *Campanularia neglecta*, Alder, and have little doubt that it is far from uncommon amongst the Hydroida. In the month of June I obtained a fine colony of the *Campanularia* bearing a full complement of polypites and also a considerable number of branches, carrying at their extremities the planuloid extensions of the cœnosarc described by Allman (Pl. XX. fig. 4, x). I am inclined to think that they were of greater length than those of *Schizocladium*, but in other respects exactly resembled them. I did not actually witness the liberation of the frustule, but in one case at least a constriction was very apparent a little within the chitinous tube of the stem, at which point no doubt separation would ultimately have taken place.

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* The gonotheca is like an exquisite little crystal cornucopia.

† Report of the British Association for the Advancement of Science, 1870; 'Monograph of the Gymnoblastic Hydroids,' part i. p. 151.

I confess that, with great deference for Prof. Allman's opinion, I am unable to accept his genus *Schizocladium*, which seems to rest on a single character, the development of fission-frustules in a certain way—a character which, there is reason to believe, may have a wide range amongst the Hydroida. There seems to be nothing peculiar in the trophosome of his zoophyte but the presence of the frustule-bearing branchlets; there is nothing in his account or figure of it, apart from this character, to indicate that it is even specifically distinct from known forms of *Obelia* or *Campanularia*.

The observation of reproduction by fission in *Camp. neglecta*, and its probable occurrence, as recorded by Allman himself, in *Corymorpha*, tend to show that *schizocladism* may be a common element in the reproductive history of the Hydroida, and that it therefore cannot be the peculiarity of a genus. The frustule with its branchlet is hardly likely to exhibit any morphological peculiarities that will serve the purpose of the classifier. It presents the same character in *Camp. neglecta* as in Allman's Hydroid, which is probably an *Obelia*.

Prof. Allman has made a most important and interesting addition to our knowledge of the modes of reproduction amongst the Hydroida; but I venture to think that he himself will hardly care to retain the new genus.

IV. Cladonema radiatum, *Dujardin*: *the Planoblast.*

[Plate XXI. fig. 6.]

Through the kindness of Dr. Hudson, of Clifton, I have had the opportunity of examining during the past summer, for the first time, the planoblast of *Cladonema radiatum*, which he had taken at Watermouth near Ilfracombe. I was surprised to find the tentacles unbranched and furnished with only one suctorial appendage. In this state they bear a very close resemblance to those of *Clavatella*, the only important difference between the two being that in *Cladonema* the thread-cells are distributed in several clusters (about five) along the arm, while in *Clavatella* they are gathered into a single spherule at the extremity. Van Beneden has observed that in an early stage the tentacle of the planoblast is destitute of branches, and is furnished with two suckers: it appears that in a yet earlier stage it has only one. Allman, in the concluding part of his great work on the Tubularian Hydroids, has made the same observation, and he adds that "in a very early stage" (before the liberation of the gonozooid) "the marginal tentacles are *quite simple.*" At the time of detachment one suctorial appendage has been developed; and, according to the observation of Van Beneden, a second makes its appearance before the branching of the tentacle commences*.

Judging from Allman's exquisite figure, the bifurcation of the tentacles begins at a later period in *Cladonema* than it does in *Clavatella*; in the latter the minute lobes on the margin of the disk, in which they originate, exhibit almost immediately a slight depression in the centre, indicating the future course of development.

I was much interested in watching the curious habits of the young *Cladonema*. It was exceptionally hardy, and throve well in confinement. But after a short time it proceeded to reverse its swimming-bell (just as a man might throw off his coat on commencing a piece of hard labour), and, firmly planting itself on its suctorial appendages, made a vigorous attack on the minute crustaceans that swarmed in the surrounding water. The manubrium, unimpeded by the restraint of the umbrella, and placed on a decided vantage ground, moved eagerly from side to side, and with the aid of its well-armed oral lobes succeeded, I have no doubt, in securing abundant supplies. The zooid in this condition presented an extraordinary figure: the characteristic grace, with much of the familiar appearance, of the Medusa had vanished; and the stout cylindrical proboscis, mounted on a kind of pedestal and swaying to and fro as the little Entomostraca played about it, offered a strange contrast to the exquisite form of which Van Beneden could say, "rien n'est gracieux comme un Cladonème."

The retroversion of the umbrella has been noticed in several species and by several observers—but always as occurring late in the life of the zooid, and shortly before the escape of the generative products. When the walls of the manubrium were already laden with ova, I have seen the swimming-bell in the planoblast of *Syncoryne eximia* thrown back and contracted into a small mass, to which the tentacles were still attached.

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* 'La Faune Littorale de Belgique: Polypes,' 1866, p. 142.

The locomotive organ perished, and the zooid in its last stage returned to the condition of the polypite. But in the case of the young *Cladonema* the umbrella, though everted, continued otherwise unchanged, and manifested its healthy condition by vigorous contractile movements; it was clear that at any moment it might be restored to its normal position, and discharge its functions as efficiently as ever.

This peculiarity of habit in the planoblast of the *Cladonema* no doubt connects itself with the presence of organs of attachment, which amongst the natatory gonozooids it alone possesses.

I may mention that I was unable to detect any thread-cells on the umbrella, nor is there any reference to their existence in Allman's description; but they are represented in Mr. Holdsworth's excellent figure engraved in my 'History of the British Hydroida'*.

V. *Zanclea* (*Gemmaria*) *implexa*, Alder.

I have to record the occurrence of this very beautiful Hydroid at Ilfracombe, where it was found on the Capstone, and dredged up from a moderate depth not very far from shore. In the former locality it grew on *Laminaria*-roots in the lower rock-pools. All the specimens obtained were spreading over masses of *Cellepora*, in the orifices of which the polypites were lodged; Mr. Hodge obtained it in the very same habitat at Seaham Harbour. Hitherto this species has only been met with on the coasts of Northumberland and Scotland.

The form found in Devonshire is the one first described by Alder as *Coryne pelagica*, which he subsequently considered to be the young of his *Tubularia* (*Coryne*) *implexa*—and is identical with the *Coryne briareus* of Allman, and the *C. margarica* (natural-size figure) of Wright. It is also the one so beautifully figured in Allman's 'Monograph' as *Gemmaria implexa*, the polypites of which are borne on short and simple stems about half a line in height. At first sight this form seems very unlike the Hydroid with branching tubes, growing gregariously and forming "a densely tangled mass" from a half to three quarters of an inch in height, which Alder has described as his *Coryne implexa*. I have little doubt, however, that the two must be referred to the same species.

I have fine specimens of *Zanclea implexa* from the Firth of Forth, kindly supplied by Dr. Strethill Wright, in which the two forms are associated. The creeping stolon gives off many short stems enclosed in a polypary, which tapers slightly downwards and is annulated throughout the greater part of its length, the upper portion, however, being smooth and of more delicate material than the rest. These are unbranched, and bear at their summit a single polypite. Associated with them are much longer stems, branched for the most part unilaterally, and invested by a polypary exhibiting the curious structure described by Alder. Polypites are borne on the summit of the main stem and of the several ramules. The polypary is composed of two layers or coats, distinctly separated from one another—the outer transparent and membranous, the inner of a decided horn-colour and for the most part strongly ringed[*]. Every here and there portions occur in which the separation of the two coats is not apparent; but throughout the greater part of the stems and branches it is strongly marked.

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* 'History of the British Hydroid Zoophytes,' vol. ii. pl. 11. fig. *c*'.

The inner tube is completely filled by the cœnosarc; its carinated rings are connected with the epidermis by frequent processes. Towards the base of the stems this singular structure is not generally distinguishable; but the "thin and transparent" polypary, which Allman describes as occurring in his specimens for some distance below the polypite, is no doubt the epidermal layer, forming in other parts of the stem a continuous distinct envelope, and enclosing the annulated tube which immediately surrounds the cœnosarc. It appears that the form with short and simple stems, associated in the Firth-of-Forth specimens with the larger branched form, not uncommonly occurs alone; and as in this condition it bears the reproductive bodies freely, it cannot be accounted immature.

That the *Tubularia implexa*, Alder, and the Firth-of-Forth species are identical is beyond a question[†]; and Dr. Wright's specimens show that the humbler form described by Alder (as *Coryne pelagica*) and by Allman, and found by myself at Ilfracombe, is only one state of the same species. A complete diagnosis of *Zanclea implexa*, therefore, must include the branched double-coated stem, which belongs to the perfect condition of the zoophyte.

The polypites have five or six large-headed tentacles round the oral extremity; the rest have very small capitula, containing a few thread-cells. I have noticed a large oval thread-cell at the base of most of the tentacles and imbedded in the ectoderm at various points, where tentacles would probably have been developed. Occasionally one occurred in the course of an arm, and a group on the surface of the body.

The gonophores are borne in large clusters, and number sometimes as many as seven. The sacs containing thread-cells on the umbrella of the planoblast were placed, in the Ilfracombe specimens, a little way above the tentacular bulbs; they are represented in the same position in Alder's figure; but Allman describes them as extending upwards for some distance from the base of each tentacle.

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[*] *Vide* 'History of the British Hydroid Zoophytes,' pl. 9. fig. 3 *b*.

[†] I have compared specimens of the polypary of the former, received from Mr. Alder, with the latter; and they exactly agree, as already observed by Wright.

I have referred the *Coryne implexa* of Alder to Gegenbaur's genus *Zanclea*, and at present I see no reason to change this view. M'Crady, indeed, has instituted the genus *Gemmaria* for a planoblast which seems to agree in all essential (generic) points with that of our British form; the trophosome he had not discovered. But I can find no sufficient ground for this addition to an already oppressive nomenclature; *Zanclea* and *Gemmaria* seem to me to embrace one and the same generic type. The main characteristics of Gegenbaur's genus are a bell-shaped umbrella, a moderately long manubrium with simple mouth, four radiating canals, tentacles springing from non-ocellated bulbs and furnished along their course with pedunculated sacs containing thread-cells, and certain prominent "ribs" on the umbrella, in which thread-cells are enclosed; and these are really the essential characters of *Gemmaria*. Allman, however, has adopted M'Crady's genus, but has not given us his reasons for doing so. It is of course possible that the structure of the pedunculated sacs on the arms of *Zanclea costata* (Gegenbaur) may differ essentially from that of the similar organs on *Coryne implexa*, Alder; but it is hardly probable. It is also possible that the "ribs" on the umbrella of the former may not correspond with the "sacs" on that of the latter, though it seems likely enough that the same kind of structure is intended in both cases. But with our present information, and looking to the whole group of characters, it seems to me better to hold provisionally at least to Gegenbaur's name.

Alexander Agassiz also accepts M'Crady's genus *Gemmaria*, and has given us his reasons; "the form of the bell," he says, "of the digestive cavity, and of the tentacles is totally different in the two genera." "The form of the bell" is a very doubtful generic character; but the differences in this respect between the supposed species of *Gemmaria* are quite as great as those between any one of them and the *Zanclea costata*. The *form* of the digestive cavity is a matter of inferior moment; there are no important differences in size or structure. The tentacles may not agree in *shape*, though there is little disagreement in this respect between *Zanclea costata* and *Zanclea implexa*; but they seem to be similar in all essential points.

On the whole I see no reason for dispossessing the established name.

LV.—*On* Campylonema, *a new Genus of Polyzoa.* By the Rev. Thomas Hincks, B.A., F.R.S.

[Plate XX. fig. 5.]

On stones and stems of seaweed collected from the Capstone at Ilfracombe a minute Polyzoon has occurred to me not uncommonly, which, though closely resembling the well-known *Valkeria* in general appearance, presents an arrangement of the tentacles so remarkable that it can only be referred to a new genus. I suspect that it may prove identical with the form which I have already characterized under the name of *Valkeria tremula**. At least there is a striking agreement between the two in the shape and size of the zoœcia, and the manner in which the colonies are distributed on the creeping stolon; and as I was unable to make a thorough examination of the polypide of *Valkeria tremula*, the peculiarity in the tentacles, supposing it to exist, might readily have escaped me. This point, however, must be left for future determination.

Class *POLYZOA.*

Order INFUNDIBULATA.

Suborder **CTENOSTOMATA**, Busk.

Family **Vesiculariidæ.**

Genus Campylonema, Hincks.

Der. *καμπύλος*, bent, and *νῆμα*, a thread (tentacle).

Generic character.—Polyzoary a filiform creeping stolon, on which the zoœcia are distributed at intervals in groups; zoœcia erect, sessile; polypides with eight tentacles, two of which are bent outwards for about two thirds of their length, so as to interrupt the circle of arms on one side; no gizzard.

Campylonema tremulum, n. sp.

Zoœcia very small and slender, oblong, tapering off to a point below.

The remarkable arrangement of the tentacles is the one point of difference between this form and *Valkeria.* The abrupt reversion of two of the arms destroys the circular form of the tentacular verticil, and gives it somewhat the shape of a horseshoe. Six of the arms stand erect as usual; the other two are thrown back, so that on one side the circle is broken. The flexure of the tentacles takes place at about a third of the whole height from the base; this peculiarity gives a very remarkable and distinctive appearance to the polypide. The zoœcia are slender, and taper off very decidedly below; when the polypide is retracted they droop a little to one side, and rise into an erect position when it expands.

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* "Catalogue of the Zoophytes of South Devon and South Cornwall," p. 58, pl. xii. fig. 9 (Ann. Nat. Hist. 1862, ser. 3, vol. ix. p. 472).

The polypides are extremely minute and delicate, and very nimble in their habits; those of *Valkeria uva* appeared coarse and clumsy beside them. They are destitute of a gizzard, and present altogether a very simple structure.

EXPLANATION OF THE PLATES.

PLATE XX.

Fig. 1. One of the lateral sarcothecæ (nematophores) of *Aglaophenia pluma*, Linn., showing the thread-cells in action: *a*, the superior lobe of the sarcostyle (*s*), which bears the thread-cells; *b*, the inferior lobe, from which the extensile processes arise; *c*, the ectoderm of the cœnosarc, from which the sarcostyle originates; *d*, the chitinous cup of the sarcotheca.

Fig. 2. The bithalamic sarcotheca of *Plumularia setacea*, Ellis, showing one of the extensile processes (pseudopodia) given off from the sarcostyle: *a*, the superior lobe with thread-cells; *b*, the extensile process; *x*, the terminal cup-shaped chamber of the sarcotheca, in which the two lobes are lodged; *y*, the inferior tubular chamber.

Fig. 3. The same, showing one of the processes (*b*) dividing into two branches, of which one tends upwards and the other downwards.

Fig. 3'. The same, showing a process with bulbous dilatation (*b*): *a*, the superior lobe; *s*, the sarcostyle.

Fig. 4. *Campanularia neglecta*, Alder: *x*, a "fission-frustule" in course of formation.

Fig. 5. *Campylonema tremulum*, Hincks, highly magnified, with one of the polypides expanded, showing the peculiar arrangement of the tentacles.

PLATE XXI.

Fig. 1. *Plumularia cornu-copiæ*, Hincks, natural size.

Fig. 2. A portion of one of the plumes, magnified.

Fig. 3. Two gonothecæ, borne on a portion of the main stem.

Fig. 4. A calycle of *Plumularia Catharina*, Johnston, showing the pedunculate sarcotheca (*x*).

Fig. 5. A gonotheca (female) of *Plumularia Catharina*.

Fig. 6. The planoblast of *Cladonema radiatum*, Dujardin, in an early stage of development.

LVI.—*Notice of some Species of Fishes from the Philippine Islands.* By Dr. A. GÜNTHER.

THE British Museum has recently obtained a series of the fishes collected by Dr. Adolf Bernhard Meyer in the Philippine Islands. The following appear to be undescribed:—

Platycephalus fasciatus.

D. 1 | 8 | 11. A. 11. L. lat. ca 100.

The angle of the præoperculum is armed with three spines, *the upper of which is twice as long as the middle one, and nearly half as long as the eye, the lowermost being minute.* The length of the head is one third of the total (without caudal), and its width between the præopercular spines nearly one half of its length. *The interorbital space is but slightly concave*, and its width one half of the vertical diameter of the eye, or two sevenths of the length of the snout. The spines of the superciliary edge and of the other ridges of the head are very small, and but slightly prominent. *Lateral line smooth.* There are eight or nine scales in a transverse series between the first dorsal fin and the lateral line. Greyish brown, with broad irregular blackish-brown cross bands—one, corresponding to the first dorsal, and two corresponding to the second, being the more conspicuous. The first dorsal and the ventrals nearly entirely black; the rays of the second dorsal and anal with large black spots; caudal with three very large irregular black blotches. Pectoral deep brown; but the membrane between the five upper rays is transparent, and these rays are spotted with brown.

One specimen, from the Bay of Manila, 9 inches long.

Otolithus leuciscus.

D. $10 \mid \frac{1}{23}$. A. 2/7. L. lat. ca 55.

Snout rather obtuse, with the lower jaw but slightly projecting beyond the upper. Both jaws with a series of distant canine-like teeth, the anterior of which form a pair of canines in the upper jaw, the lower jaw being without canines in front. There are eight scales in a transverse series between the spinous dorsal fin and the lateral line. The height of the body is a little less than the length of the head, and two sevenths of the total (without caudal). The diameter of the eye is a little less than the length of the snout and two ninths of that of the head. The width of the interorbital space is somewhat more than the diameter of the eye. Præoperculum distinctly serrated. Fins scaleless. Anal spine feeble. Coloration uniform silvery; vertical fins slightly blackish towards the margin.

Two specimens, from the Bay of Manila, 6 inches long.

Atherina lineata.

D. $4 \mid \frac{1}{8}$. A. $\frac{1}{11}$. L. lat. 37. L. transv. 7.

Evidently closely allied to *A. endrachtensis*.

The height of the body is two ninths of the total length (without caudal), the length of the head one fourth. Eye very large, its diameter being equal to the width of the interorbital space, and contained twice and one third in the length of the head. Snout very short, one third of the diameter of the eye. Pectoral long and pointed, as long as the head; dorsal small, its origin nearly midway between the end of the snout and the extremity of the caudal. The silvery band is narrow, bordered above and below by a very conspicuous series of black dots; a third series of similar dots runs along the middle of the row of scales below the silvery band.

Two specimens, 3¼ inches long, from Cebu; we have received also two others from Amboyna.

Salarias holomelas.

D. 30. A. (2+) 19.

Allied to *Salarias fuscus.*

Body comparatively short, its depth being contained thrice and one eighth in the total length (without caudal). Anterior profile of the forehead nearly vertical. Canine teeth none. No orbital tentacle, no crest on the head. The dorsal fin is not notched; this fin, as well as the anal, is elevated, all the spines and rays terminating in very fine filaments; both fins connected by a short membrane with the caudal, which is also produced. Entirely black.

One example, 3 inches long, from Cebu.

LVII.—*On the Species of Asiatic two-horned Rhinoceros.*

By Edward Blyth, Hon. Memb. As. Soc. &c.

In some remarks on two species of Asiatic two-horned rhinoceros (*Ceratorhinus* of Gray) which appeared in the 'Annals' (*anteà*, p. 208), Dr. Gray awards to me the discredit of supposing "that the one inhabits the east coast of the Bay of Bengal and the series of islands extending to Sumatra, and the other the Malay peninsula and Tenasserim, separated in Burmah by the Irrawaddy river." Now as that is a part of the globe with the geography of which I happen to be tolerably familiar, and as, moreover, I have especially studied the fauna of the Andaman and Nicobar Islands and was the first to bring to notice sundry species inhabiting those islands, it is therefore somewhat unlikely that I should have suspected them of harbouring such an animal as a rhinoceros, or that I should have ignored the fact that the Tenasserim provinces and northern part of the Malayan peninsula constitute, equally with the provinces of Chittagong and Arakan, portions of the eastern boundary of the Bay of Bengal.

I do know for certain that the small blackish and coarse-haired rhinoceros procured at Malacca, an example of which died lately in the Regent's Park, is identical with one of those inhabiting the Tenasserim provinces,—also that a two-horned species of some kind inhabits the province of Arakan, which I presume to be the same as that obtained in the contiguous province of Chittagong, viz. *R. lasiotis*, Sclater. But at present there is no evidence to show that the latter exists southward (or to the south-east) of the Gulf of Martaban, unless the figure of a Tenasserim skull published in the 'Journal of the Asiatic Society of Bengal' (vol. xxxi. p. 156, pl. iii. fig. 1) represents that of *R. lasiotis*, which is not improbable. That the latter is the two-horned species which has been killed (as I was assured by a planter) in Assam, where it is considered an exceedingly great rarity, is very highly probable; and Dr. J. Anderson mentions that while at Bhamô, in Upper Burmah, he "was informed by an intelligent native that two-horned rhinocerotes are found in the Mogonny district, which is close to the confines of Assam, and as far north as the twenty-sixth degree of north latitude" (Proc. Zool. Soc. 1872, p. 129).

The larger of the two obviously distinct species which we have seen alive in London (*R. lasiotis*, Sclater) is considered by Dr. Gray to exemplify the true *R. sumatrensis*; while the smaller of the two he imagines to be identical with the animal which bore the long and much-curved anterior horn upon which *R. Crossii*, Gray, is founded (*vide* figure in Proc. Zool. Soc. 1854, p. 250). Mr. Sclater with much better reason, as it appears to me, assigns the smaller species to the veritable *sumatrensis*; but this can hardly be the same Sumatran animal as is figured under that appellation by Professors Temminck and H. Schlegel.

That *R. Crossii* and *R. lasiotis* are the same I think extremely probable; for I have seen well-developed horns attached to the skin of the head of a Tenasserim male of the small blackish species, the skull of which was afterwards cleansed, and is figured together with those horns in 'Journ. As. Soc. Beng.' (*loc. cit.* pl. iv. fig. 1). Though of similar peculiar character, the anterior horn curves much less than in *R. Crossii*; while that the very remarkable amount of curvature of the latter is normal is shown by the existence of a second, though less developed, specimen of a horn in the museum of the London Royal College of Surgeons, bearing the number 3086. In both cases (or species) the horns are very slender except at the base, and the structure of them is very much harder and more compact than in other rhinoceros-horns; for which reason they command so high a price among the Chinamen (to be elaborately carved upon) that fine specimens are hardly ever procurable by Europeans; and therefore it is that we do not see them in our museums. The size of the *R. Crossii* horn would suit *lasiotis* rather than the other; and I think it probable that the second or posterior horn will prove to be much shorter than in the smaller species. The British-Museum specimen, upon which the name *Crossii* was founded, measures 32 inches over the curvature, and is 17 inches in span from base to tip.

R. sumatrensis was originally described, and somewhat rudely figured, by Surgeon Bell in the 'Philosophical Transactions' for 1793 (p. 282, pl. 2). His specimen is stated to have been a male; "the height of the shoulder was 4 feet 4 inches" (over the curvature of the body?); "from the tip of the nose to the end of the tail 8 feet 5 inches. From the appearance of the teeth and bones it was but young, and probably not near its full size. The general colour was *a brownish ash*; under the belly, between the legs and folds of the skin, a dirty flesh colour. . . . . The ears were *small and pointed, lined and edged with short black hair*. . . . . The whole skin of the animal *is rough, and covered very thinly with short black hair*." Sir T. Stamford Raffles remarks of the animal, as observed by himself in Sumatra, that "its hide is much softer and more flexible than in the Indian one, and is not, like it, corrugated into plates of mail; it has, however, some doublings or folds, particularly round the neck, shoulders, and haunches, *rather more distinct and defined than in Bell's drawing*" (Trans. Linn. Soc. vol. xiii. p. 268). Upon the whole, this description applies fairly to the stuffed specimen in the British Museum, which is believed to have been procured at Pinang, meaning the adjacent mainland of province Wellesley; but it does not suit *R. lasiotis*, either as regards the prevailing shagginess of the hide, the length and colour of the hairy vesture, the very conspicuous long pendent fringe of hair bordering (but not lining) the ear-conch, and the copiously tufted tail. But the latter is represented in Bell's figure as being slightly tufted, and not so long and tapering as in the animal from Malacca, the tail of which had some scattered hairs upon it but was not distinctly tufted; in the British-Museum specimen the tail is mutilated. Moreover the skin of *R. lasiotis* would rather be described as smooth than as rough; and in this respect it contrasts remarkably with that of the smaller species.

In his 'Histoire Naturelle des Mammifères' M. Frédéric Cuvier supplies two figures assignable to this type of rhinoceros (*Ceratorhinus*, Gray), one of which is obviously from a drawing from life of a very young calf, which he erroneously refers to the conspicuously distinct single-horned rhinoceros of Java; and in his supposition of its representing the latter, he either overlooked or possibly ventured to suppress the indication of a second and posterior horn, which could scarcely fail to have been shown in the original drawing. Even at that early age a rudiment of the posterior horn must needs have been sufficiently apparent in the living animal, as shown by Schlegel's figure of a still younger calf. The comparatively rough skin (although in so very juvenile an individual), the blackish-brown colour of that skin, and especially the length and peculiar form of the tail combine to identify the animal with the small blackish species inhabiting the Tenasserim provinces and Malayan peninsula; but still I do not understand its being represented as so very slightly hairy, especially upon the ears, which is hardly to be sufficiently accounted for by the youth of the particular specimen.

M. Frédéric Cuvier's other figure, which he assigns to *R. sumatrensis*, appears to me to have been made up from that of Bell, aided and partly misled by the remark of Raffles concerning the plaits or creases of the skin. I do not believe that any original figure of a *Ceratorhinus* would have represented the crease on the flanks as extending upwards across the loins. The attitude and position of the limbs are essentially the same as in Bell's figure; and so also is the amount of development of the horns; and the accompanying descriptions and measurements of both *sumatrensis* and supposed *javanicus* are compilations. Moreover it is erroneously asserted that *R. sumatrensis* was named *R. sondaicus* by Messrs. Raffles and Horsfield, inasmuch as that name was first applied by George Cuvier to the lesser one-horned species, which is the only rhinoceros that inhabits Sunda, *i. e.* the western half of Java. It follows that F. Cuvier's figure assigned to *sumatrensis* is of no authority whatever in determining whether either or which of the species in question is properly entitled to that designation.

Lastly, the figures assigned to *R. sumatrensis* (adult and young) by Professors Temminck and H. Schlegel were made up from stuffed specimens in the Royal Museum of Natural History at Leyden; and the fore limbs of the adult are represented as being much too slender. Otherwise those figures resemble *R. lasiotis* rather than the small blackish species, and have the comparatively short tail of the former; but they are represented as being very inconspicuously clad with minute hairs, which would scarcely be remarked unless especially looked for. I remember distinctly that the stuffed adult specimen in the Leyden Museum is hairless (unless to a very slight extent where least exposed), and that the young (under glass) was well clad; but not suspecting at the time a plurality of species of the particular type, nor how such species have since proved to differ, I did not examine those specimens so critically as I should now do, though I retain the impression that the adult is notably larger than the stuffed male in the British Museum, or than the aged female of the same species which lately died in the Zoological Gardens. The skeleton of a Sumatran female in the museum of the Royal College of Surgeons agrees in size with the last mentioned; but although a very old animal, it retains its front teeth, which the others had lost. But the skull of a Sumatran male in the same collection indicates a considerably larger animal, which may even be of a different specific race, corresponding to Schlegel's figure; but this is a matter for further investigation, and to which I can only recommend attention. The Leyden beast is certainly not so large by a good deal as is the living *R. lasiotis*, which appears to be still growing, and has much increased in size since its arrival in this country; but it is not likely to become so large an animal as the adult of the lesser single-horned species (*R. sondaicus*), of which a skull, said to be undoubtedly from Sumatra, has lately been received at the British Museum.

I was assured at Leyden by Professor Schlegel that *R. sumatrensis* existed in Borneo; but an anterior horn said to be from Borneo, in the possession of Mr. A. D. Bartlett, would seem to indicate a species of still more diminutive size than that which I believe, with Mr. Sclater, to be the real *sumatrensis* of Bell, the mere difference of size of horn being not the only reason for suspecting that the Bornean rhinoceros will eventually have to be recognized as a peculiar species.

I may also here mention that upon looking over a portfolio of drawings at the India House, belonging formerly to the Earl of Mornington (Governor-General of India and subsequently Marquis of Wellesley), I found two of single-horned rhinoceros. One of these is a fair representation of a very young individual of *R. sondaicus*; the other—which, however faulty in general outline (being much too deep in the body), is finished elaborately as regards details—appears to me to represent a peculiar and undescribed species. The folds of the cuirass are the same as in both *indicus* and *sondaicus*, except the one which crosses the nape in the latter, and is deflected backward across the shoulder-blade in the former; this one is intermediate in its direction, for it is deflected backward much higher upon the shoulder than is regularly the case in *R. indicus*. The most remarkable peculiarity, however, consists in the cuirass being throughout conspicuously studded with uniformly small tubercles (as in *R. sondaicus*), while the head and limbs are represented as wrinkled, but the skin quite smooth and devoid of tubercles, and in this respect contrasting remarkably with the adjacent parts of the cuirass. I cannot think that any one who looks at the elaborate finish of this drawing from a living animal can readily suppose the peculiarities described to be freaks of the native artist; and in the other figure (of indubitable *R. sondaicus*) the head and limbs are represented as being tuberculated uniformly with the cuirass. Moreover, in the figure of very juvenile *R. sondaicus*, a slight hairiness is represented upon the back, between the shoulder-fold and that which crosses the loins; and I doubt not that this is correctly copied from the living specimen. No habitat is assigned to either, nor aught given to guide respecting the dimensions; but, without desiring to attach undue importance to any drawing made by an unscientific artist, I still cannot help thinking that the one in question indicates, in all probability, a species hitherto unsuspected—as much so as were, until quite recently, the additional species of Asiatic two-horned rhinoceros, which must now be generally recognized and accepted. Be it remembered that for many years a male of *R. sondaicus* existed in this country which was never recognized as differing from the large *R. indicus*; and we only know it now from the two figures of it, assigned to *R. indicus*, in the 'Naturalist's Library;' while the skeleton of an adult *R. sondaicus* in the anatomical museum of Guy's Hospital, in Southwark, is in all probability that of the same individual, which was exhibited about the country and finally deposited in the Zoological Garden of Liverpool, at a time when the larger of the two Indian species was much less familiarly known to us than it is at present. That particular specimen of *R. sondaicus* was received from Calcutta; and it is the only species which is known to inhabit the Sundarbáns of Lower Bengal, as it is also the only single-horned species known to inhabit the Indo-Chinese countries and contiguous Malayan peninsula. Although the commonest and most widely diffused of any Asiatic rhinoceros, I can learn of no other example of it having ever been exhibited in Europe.

Note.—Since the above was in print I have seen Mr. Sclater's paper on the Asiatic two-horned rhinoceroses, published in 'Nature' for October 24th, 1872 (pp. 518, 519), and accompanied by figures of *R. lasiotis* and *R. sumatrensis*. Unfortunately they are not on the same scale, so that the former is made to appear the larger of the two, and the attitude of *lasiotis* does not permit of the distinctions being sufficiently shown. At present the tail of the living animal is much more largely tufted, and the long hair fringing the ears is more developed, than appears from Mr. Sclater's figure taken from the animal when younger; nor is the different quality of the hair upon the body sufficiently apparent. In *R. sumatrensis* this is shorter, much coarser, suberect, and of a black colour—in

R. lasiotis longer, more appressed (or tending to lie flat on the skin), of a light greyish-brown colour, and somewhat glistening at certain angles of vision. In *R. sumatrensis* the muzzle anterior to the nasal horn is much broader, and the space between the ears is proportionally much less. Moreover Mr. Sclater states that "the tail of the Malacca animal is shorter and nearly naked; in that from Chittagong it is longer and tufted at the extremity;" on the contrary, it is conspicuously shorter in *R. lasiotis*, and even with its tuft does not descend so low as in the other. That of *R. sumatrensis* is correctly represented in Mr. Sclater's figure of the species, in which also the very strongly marked crease behind the shoulders is not at all exaggerated.

MISCELLANEOUS.

Varieties of the Tiara (Galera barbata).

By Dr. J. E. Gray, F.R.S. &c.

This animal is generally brown, with a pale head and a large white or yellow blotch on the throat. It has a large distribution in the tropical or subtropical parts of America.

The British Museum has lately received two half-grown specimens, which have the whole head, neck, and front of back between the shoulders pure white; one of the specimens has the chin and middle of the throat grey. These come from Xalapa in Mexico.

Mr. Salvin sent to the Museum a specimen from Costa Rica, which is entirely black, without any pale colour on the head and neck; and there is a young specimen in the Museum which is entirely of a pale whity-brown colour.

On Branchipus *and* Artemia. By C. Vogt.

At the meeting of the "Société Helvétique des Sciences Naturelles" held at Fribourg in August last, M. Vogt gave a summary of the results of his researches upon these genera. The first species investigated by him was *Branchipus diaphanus*, found in August 1871 near the summit of the Reculet (Jura), in artificial ponds dug by the herdsmen for the use of their cattle. M. Vogt obtained several hundred individuals of this species, among which the males and females were nearly in equal numbers. When placed in an aquarium they lived there very well at first, and produced a multitude of eggs, from which larvæ issued; but towards the end of September they all perished by degrees. At the approach of cold weather the water was emptied out of the aquarium, leaving only the mud at the bottom, which was completely frozen during the winter. Towards the end of February the aquarium received some new inhabitants, namely about 50 larvæ of *Petromyzon*, which concealed themselves in the mud. In the month of May of the present year a certain number of larvæ of *Branchipus* made their appearance, being hatched, no doubt, from eggs which had remained in the mud. M. Vogt succeeded in rearing several generations of them, which enabled him to follow all the phases of their development. Several excursions to the Reculet during the present year furnished no results; no traces of *Branchipus* could be found in that locality.

Wishing to compare *Branchipus* with an allied genus, M. Vogt applied to Prof. C. Martins of Montpellier, to ask him for some specimens of *Artemia salina*, a species of Branchiopod which swarms in the salt marshes of the neighbourhood of Cette. M. Martins sent several thousands of these animals, with a supply of the mother liquors in which they live. They arrived at Geneva in good condition, and are living in an aquarium, in which they produce enormous quantities of eggs and larvæ.

M. Vogt exhibited a bottle filled with living *Artemiæ* and their larvæ and explained the structure of the adult *Branchipus*, describing, among other things, a pair of footjaws which had escaped the observation of MM. Joly, Leydig, &c. He then dwelt upon the form of the larvæ, which in both *Artemia* and *Branchipus* exhibit the primitive fundamental type of the Crustacea, to which the name of *Nauplius* has been given. But although fundamentally the same, the *Nauplii* of the two genera present considerable differences, those of *Branchipus* being shorter and more compressed, and those of *Artemia* more slender and elongated. The lateral compound eyes appear much later in *Artemia* than in *Branchipus*.

The first pair of appendages in the *Nauplius* consists of two antennæ which afterwards become the antennæ of the perfect animal. The second pair forms the chief or sole organ of locomotion of the larva; and after numerous moults these appendages finally become the horn-shaped pieces which serve as prehensile organs in the male *Branchipus* and are rudimentary in the female. The third pair serve the larva to carry its food to its mouth; in the adult it forms the mandibles, which constitute the third pair of appendages. The eleven pairs of natatory feet and the pair of footjaws of the adult originate subsequently by budding.

M. Vogt confirms the observation of M. Joly that among the *Artemiæ* collected at Cette during the months of July and August there are no males, and that the females propagate by parthenogenesis. This fact is the more remarkable as we find males in great abundance in other salt marshes inhabited by the same or analogous species.—*Bibl. Univ.* Sept. 15, 1872, *Arch. des Sci.* p. 30.

On Osteocella septentrionalis *from British Columbia.*

By Dr. J. E. Gray, F.R.S. &c.

The substance described by me in the 'Annals, 1872, ix. p. 406, under this name was, at the meeting of the British Association at Brighton, and since in 'Nature,' regarded as the notochord of a fish! Professor Dawson of M'Gill College, Montreal, Canada, states that it was submitted to Professor Verrill of Yale College, who "had no doubt as to its nature" (that is, of its being the axis of a *Virgularia* or some similar creature), "but believed it probably belonged to an undescribed species." Dr. Dawson states that Mr. Selwyn's specimen has "attached to the granulated lower extremity some trace of animal matter, in which I think I can detect, under the microscope, a few club-shaped spicules."

The observation of Professor Verrill is interesting, as since I described it I thought it might probably be the axis of a species of his genus *Stylatula*, which has a subcylindrical axis instead of the quadrangular one of *Virgularia*, and of which he describes two species from California; but Professor Verrill does not recognise it as being a species of that genus.

Sowerby and Lear's 'Tortoises.'

To the Editors of the Annals and Magazine of Natural History.

GENTLEMEN,—In the notice of Sowerby's Plates of Tortoises &c. recently published by Sotheran, edited by Dr. J. E. Gray, it is stated that "Many of the specimens figured and the rest of Mr. Bell's collection of reptiles are now to be found in the Anatomical and Zoological Museum at Cambridge."

This statement is incorrect, as Professor Bell's collection of reptiles (both in a dry condition and in spirit) was purchased by the late Rev. F. W. Hope, and was by him presented to the University Museum of Oxford. Professor Bell's admirable collection of Crustacea is also in the same museum, having been purchased by myself and presented to the University on my appointment as Hope Professor of Zoology.

I am, Gentlemen,
Your obedient Servant,
J. O. WESTWOOD.

The correctness of the statement in Dr. Gray's preface to this work having been called in question, we thought it our duty to submit Prof. Westwood's letter to Dr. Gray, from whom we have received the following answer:—

British Museum,
October 24th, 1872.

MY DEAR FRANCIS,—Mr. Westwood's letter is entirely erroneous. I have had one specimen of Mr. Bell's lent me by Prof. Newton; and I have consulted the others in the museum of the Cambridge Philosophical Society, where they were before they were transferred to the Anatomical Museum. I never before heard that Mr. Bell had a second collection, and think it must be a mistake; I knew the collection of Crustacea was purchased by Mr. Westwood.

Yours truly, J. E. GRAY.

The Ahu (Capreolus pygargus). By Dr. J. E. GRAY, F.R.S. &c.

We have three specimens of this animal in the British Museum—one from North China, and the others from Siberia; they are of very different sizes.

The Siberian specimens, male and female, are much the largest. They stand 38 inches high at the withers, and the length from the nose to the place of the tail is 53 inches; length of the hind leg to the hock 16 inches. In the specimens in the museum the horns are very slender, elongate, nearly smooth, and simple; one has a single branch on the inner side near the tip.

The Chinese specimen, on the other hand, is much smaller, about the size of the common Scotch roebuck, and of the same dark colour as it is in the summer. The horns are stout and long, with distinct anterior and posterior snags, and have numerous beads round various parts of the lower half, some of which are large and covered with tubercles. Height at the withers 26 inches; length to the place of the tail 41 inches; length of the hind leg to the hock 12 inches.

A new British Callithamnion. By Dr. J. E. Gray, F.R.S. &c.

The *Seriospora Griffithsiana* has long been known as an inhabitant of the coast of Devonshire. Agardh refers it to the genus *Callithamnion*, and calls it *C. seriospermum*—which was the specific name that Mrs. Griffiths first gave to it; and she was the first discoverer of it. Dr. Harvey considered it a variety of *Callithamnion versicolor*, but afterwards corrected this. We have never yet found specimens of the true *Callithamnion versicolor* on the British coast; for it is very distinct from *Callithamnion corymbosum*, of which Dr. Harvey thinks it is a synonym.

Mr. Holmes kindly presented to Mrs. Gray a series of specimens which he had obtained in Plymouth Sound, of a form which, he said, had only been observed very lately, and differed from the usual *Seriospora*, which has the spores at the end of the branches, in having them in the first lower branchlet on the inner side of the branches, as in other *Callithamnia*. I have examined the specimens; and there is no doubt of their being the true *Callithamnion versicolor*, very distinct from the *Seriospora*. The *C. versicolor* has the spores triangularly divided, while in the genus *Seriospora* they are cruciately divided. It is a most interesting addition to our flora.

It is very curious that the majority of the Plymouth collectors regard *Seriospora Griffithsiana* and *Callithamnion versicolor* as varieties of the same species, the different kinds of fruits being productions of different seasons on the same plant; but they must have overlooked the different forms of the sphærospores.

On Macroxus tephrogaster. By Dr. J. E. Gray, F.R.S. &c.

In the 'Annals and Magazine of Natural History' for 1867 (xx. p. 431) I described a species of American squirrel as *Macroxus tephrogaster*, which was sent from Guatemala, Bogota, and Honduras; I also mentioned that M. Sallé had sent it from Mexico.

Mr. E. Gerrard, Junior, has shown me five specimens from Medellin, Antioquia, in the New-Granadan Confederation, South America. They are all not above half the size of the more southern specimens; and I should be inclined to regard them as a variety or species, under the name of *Macroxus medellinensis*.

Two specimens in the Museum, bought from Mr. Gerrard, Junior, vary in the extent of the black mark and of the white on the underside. In the larger specimen the dorsal patch begins at the back of the neck and extends to the base of the tail, being very broad just behind the shoulders, and the white on the underside only occupies the middle of the throat, chest, and belly, the sides being greyish, having the rest of the hairs black. The smaller specimen has a very indistinct dorsal streak, with a squarish black spot on the middle of the back, which appears to be further back than the broad part of the patch on the other specimen; the throat, chest, abdomen, and inside of limbs much more white than in the other specimen.

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LVIII.—*On a new Family and Genus and two new Species of* Thelyphonidea. By the Rev. O. P. Cambridge, M.A., C.M.Z.S.

[Plate XXII.]

In September 1871, among numerous spiders of great interest received from Ceylon from Mr. G. H. K. Thwaites were several other minute Arachnids. At first sight I was inclined to pass them over as very young examples of some species of *Thelyphonus*; but a closer examination showed them to be not only destitute of eyes (no vestige of a visual organ being apparent), but presenting some other remarkable differences in form and structure from the genus *Thelyphonus*. The principal of these differences (which seem to render it necessary to form a new family to receive these arachnids) are the subdivision of the cephalothorax into two segments, the broad fore part, and the convexity of the first segment (including the caput), whose fore margin is prolonged into a central pointed beak-like prominence: other interesting and important generic and specific characters are also detailed below. As far as I am able to determine, the examples comprise two species.

Mr. Thwaites informs me that these arachnids were found by M. Ferdinandus (the successful discoverer of the four-eyed spiders, *Miagrammopes*, Cambr.) among decayed leaves &c. on the ground. The absence of eyes was observed by M. Ferdinandus, who begged Mr. Thwaites to call my attention to it.

The discovery of a blind arachnid thus above ground is a remarkable fact. As far as I am aware, there is no instance on record of any blind creature having ever been found except in caves, where (the supposition is) the eyes have become gradually and at length totally obsolete from ages on ages of disuse. If in the present instance the eyes of this Ceylon arachnid have vanished from a similar cause, the light having been shut out merely by the interposition of decayed leaves, it would seem to show, on the part of these creatures, a persistency in keeping out of the light almost amounting to a quasi-suicidal determination.

Although undoubtedly a near ally to *Thelyphonus*, yet a strong general resemblance to *Solpuga* may be traced in the form and segmentation of the cephalothorax. The rough sketches of the main features of form and structure, added to the subjoined descriptions, will, it is hoped, give a better idea of the peculiarities of these small but very interesting arachnids than could be formed from description alone.

Order THELYPHONIDEA.

Fam. nov. **Tartarides.**

Nearly allied to the family *Thelyphonides*, but differing in the general form, which is more elongate. The cephalothorax also is divided into two parts or segments; the first comprises the caput and segments belonging to the first two pairs of legs, the hinder part (much the smallest) comprises the segments pertaining to the third and fourth pairs of legs; but in neither part are these segments indicated by any groove or indentation. The abdomen is segmented, or rather covered both above and below with articulated, corneous, transverse plates; the upper series is separated from the lower, being divided from it by a horizontal narrow divisional line or space; it terminates with a short tail, varying in form in different species, and issuing from the last of several small postabdominal rings or segments.

Gen. nov. NYCTALOPS.

Cephalothorax divided into two parts, oblong, tolerably convex above; the foremost part greatly the largest and of a somewhat oblong form, broader before than behind, the fore corners depressed and rounded; the central part of the fore margin is prolonged into a strongish pointed rostrum or beak, the point of which is a little depressed; the hinder part is broader than long, and appears to be simply an arched covering to the sternal surface, upon which the two hinder pairs of legs are articulated.

Eyes none.

Falces strong, much deeper than broad, of a flattened cylindrical form; they project in the same plane as the cephalothorax, and terminate with a movable, sharp, curved fang, which appears to be destitute of teeth.

Palpi very strong, 5-jointed; each issues from a large, strong, long, nearly cylindrical basal joint or maxilla, the inner fore corner of which is prolonged into a sharp strong point; the other joints are armed variously with teeth; and the final or digital joint terminates with an apparently movable, sharp, curved fang.

Legs moderately long, 7-jointed, those of the first pair much the longest, slender, and palpiform; the tarsal joint of this pair is divided into several minute articulations, and without any terminal claws; the tarsi of the other three pairs appear to be undivided, and each is furnished with three simple, curved, terminal claws; the femora of the fourth pair are of inordinate strength.

Abdomen covered above and below with transverse horny plates, and ending with a variously formed, short, caudal prolongation.

Sternum situated beneath the fore portion of the cephalothorax, between the basal joints of the legs of the first two pairs, of a somewhat hollow-sided pentagonal form, considerably drawn out behind. There is no sternum, properly so called, connected with the basal joints of the legs of the two hinder pairs, these being articulated to the general sternal surface of that portion of the cephalothorax.

Nyctalops crassicaudata, sp. n. Pl. XXII. fig. 1.

Length 2½ lines.

The general colour is yellow-brown, the cephalothorax being of a rather darker though duller hue than the rest, and the palpi and falces a little richer and brighter, with red-brown edgings to their different articulations.

The *legs* are sparingly furnished with hairs and fine spine-like bristles; the two superior terminal claws are long, moderately strong, simple, and curved, the inferior one small and sharply bent downwards; their relative length is 1, 4, 2, 3, those of the first pair much the longest, slender, and without terminal claws; the tarsi short, and subdivided into about six minute articulations.

The *palpi* issue from the maxilla by a narrowish neck, but quickly swell out into a strong tumid first joint, which has a moderately strong, curved, sharp-pointed tooth at its lower outer fore corner, and another smaller one opposite to it on the inner side; the second joint is still stronger, longer, and also more tumid; the third is not so large, but very nearly as long, rather bent, and with a moderate strong sharp tooth directed forwards on its underside; the fourth joint is a little longer than the third and straighter, and appeared to be somewhat serrated beneath; the fifth or digital joint is a little curved, slightly tapering, and has a sharp terminal claw, which appeared to be movable; beneath the fifth joint are some small teeth.

The *abdomen* has eight transverse corneous plates above, and seven beneath; the first of those beneath is much the largest, and probably conceals the sexual parts, which, however, presented no external aperture beyond a line-like fissure: near the fore margin of each of the three succeeding plates are two small reddish-brown transverse slits, probably the openings to the breathing-apparatus; these openings form two parallel longitudinal rows. In this view the spiracular openings would be six in number; but it was difficult to determine whether or not there were two others connected with the hinder margin of the first segment. Several very narrow plates, decreasing rapidly in size, form a sort of postabdominal continuation, terminating with a caudal appendage of a peculiar form, somewhat resembling the fluke of an anchor blunted at the point and rounded at the hinder corners; from this appendage there issue a few long, straight, slender, diaphanous, spine-like bristles, of which there are also numerous others beneath the hinder part of the abdomen.

Several examples of this species were received from Ceylon (where they were found, under decayed leaves and rubbish, by M. Ferdinandus in the Royal Botanic Gardens), and kindly sent to me by Mr. G. H. K. Thwaites, together with numerous rare and new spiders.

I could not determine with any certainty whether or not these examples were adult, or, indeed, of which sex they were; there was no apparent difference whatever of form or structural detail by which the sex might be concluded.

Nyctalops tenuicaudata, sp. n. Pl. XXII. fig. 2.

Length 2¼ lines.

In general form, structure, and colour this species resembles the foregoing; but it may readily be distinguished by the almost total absence of the teeth at the extremity of the first joint of the palpus, these being quite rudimentary; those on the other joints also appeared to be wanting; another strong character is also furnished by the caudal appendage being slender and cylindrical. Possibly this may be the female of the former species; I am, however, inclined to think that it is distinct.

Several examples were found in the Ceylon collection received from Mr. Thwaites.

EXPLANATION OF PLATE XXII.

Fig. 1. *Nyctalops crassicaudata*: *a*, profile, greatly enlarged; *b*, cephalothorax, abdomen, and falces, upperside, with legs truncated and palpi absent; *c*, underside, showing maxillæ and sternum; legs and palpi truncated; *d*, first two joints of right palpus, from outer side in front; *e*, hinder extremity of abdomen, showing caudal appendage, from underside; *f*, profile of fore part of cephalothorax, showing falx and fang; maxilla and portion of first joint of palpus truncated; *g*, natural length, exclusive of caudal appendage.

Fig. 2. *Nyctalops tenuicaudata*: *a*, left palpus, from outer side; *b*, hinder extremity of abdomen, showing caudal appendage; *c*, left leg of fourth pair, from the outer side; *d*, first two joints of right palpus, from outer side, rather in front; *e*, natural length, exclusive of caudal appendage.

LIX.—*On* Balænoptera patachonica *and* B. intermedia.
By Dr. H. Burmeister*.

An interesting acquisition is the skeleton of the whale met with in our river near the mouth of the Rio de Jujan during the month of August. Unfortunately the skeleton is not complete, owing to the negligence of the people who cleaned it provisionally; it wants the extreme point of the tail and the ends of both fins, which defect greatly diminishes its scientific value.

The skeleton belongs to the species which I have described (Proc. Zool. Soc. 1865, p. 191) under the name of *Balænoptera patachonica*, and completes our knowledge of that species, founded on an imperfect specimen, which showed some characters of importance—and proves, by its perfect identity with that specimen, that the other whale received last year (see Boletin, p. vii) does not belong to the same species, but is quite different, as I can now confidently prove by comparison of the two entire skeletons.

The whale now found was, according to the information given by the sailors, 22 varas or 58 feet in length; but as I did not see the animal before the body had been dried, I cannot accurately describe its external appearance. Therefore the only subject for comparison is the skeleton, the general characters of which I will now give.

The specimen in question was, like the other, rather young—as is proved by the vertebræ separate from the free apophyses, and also by the skull, in which the maxillary bones are easily separated from their sutures. Although the entire skeleton is not shorter than that of the species described in the 'Boletin' (p. viii), the whole breadth is less, which is a proof that this was a more slender species than that found last year. In order to prove this difference, I give some of the principal measurements of the cranium, naming last year's species *Balænoptera intermedia*, on account of its affinity with the species above described as *B. patachonica*, adding to these measurements those of the third and much smaller species described as *B. bonaërensis*.

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* Translated by Miss Miers from the 'Boletin del Museo publico de Buenos Aires,' 1871, from a corrected copy with additions sent by the author.

Measurements in English inches.

	B. intermedia.	*B. patachonica.*	*B. bonaërensis.*
Length of the base of the cranium from the occipital hole to the tip of the vomer	128	122	80
Breadth of the cranium between the anterior points of the orbits	68	62	42
Central breadth of the vertex between the temporal fossæ	39	33	24
Length of the plane of the vertex	32	28	26
Length of the upper jaw ..	102	102	70
Length of the lower jaw ..	136	138	92
Length of the intermaxillary bone	102	100	63
Breadth of the base of the nose	19	16	10½
Length of the apophysis of the temporal bone	24	22	12
Width of the shoulder-blade	40	37½	32
Greatest breadth of the cranium, between the apophyses of the temporal bones	72	67	48

The vertebral column has had probably sixty-two to sixty-four vertebræ—that is to say, four less than in the other species; but not more than fifty-eight and a half have been preserved, the end of the tail with the caudal fin having been cut off by the sailors, who found the body of the animal floating in the river. Each one of these vertebræ has a smaller body than the corresponding one in the other species, although its apophyses are a little longer and also rather broader. In order to prove this remarkable difference, I give the measurements of the thirty-fifth vertebra in each individual, which vertebra is one of the largest of the skeleton. This vertebra in *B. patachonica* has a height in the body (with the spinous apophysis) of 30 inches, of which 10 are occupied by the body, and a breadth between the transverse apophyses of 34 inches, the breadth of the body being 12 inches; whereas in *B. intermedia* the same vertebra is 28 inches in height, with 12 inches in height of the body, and 32 inches in breadth, with 14 inches in breadth of the body; which difference appears to me sufficient indication of a specific difference between the two animals.

The fifty-eight and a half vertebræ are distributed in the following manner. There are seven well separated in the neck; the five posterior very slender, two inches thick in the body, and with two free apophyses excepting in the first two (the atlas and axis), which are a good deal larger and have not free apophyses, the atlas on both sides, the axis on the anterior side. The axis has two large closed lateral wings, including an oval aperture; the three following are open, with two curved apophyses, but separated at the end; the sixth has a lower and shorter apophysis; and the last has no lower apophysis at all. In *B. intermedia* all the vertebræ of the neck are broader in the body, but the apophyses are shorter; and this species has a lower and tolerably large apophysis on the sixth vertebra, which is wanting only on the seventh.

The seven vertebræ of the neck are followed by sixteen dorsal vertebræ, with the same number of pairs of ribs—that is, one pair more than in the other species, now called *B. intermedia.* This difference seems to me of great importance, principally on account of the constant difference of the corresponding ribs, which are all longer and larger to the very end in *B. intermedia* than in *B. patachonica,* and very different also in the shape of the upper part of the rib, and of the tubercle of each rib. Each rib of the first pair is 3¼ feet in length in *B. patachonica* and 3¾ in *B. intermedia.* In the former species the head of the rib is slender and the tubercle rather large; in the latter the small tubercle can scarcely be said to be separate, and the head of the rib is larger, scarcely separated from the neck, which is also large. The second rib of *B. intermedia* is 5 feet in length, and the same rib in *B. patachonica* 4⅓ feet; the longest rib, which is the sixth, measures in the former species 7 feet 2 inches, and in the latter 6 feet 8 inches. We may infer from these differences that the body of *B. intermedia* must have a much larger circumference than that of the other species, and that its general shape must be less slender, as we said at the beginning of our comparison.

The number of the lumbar vertebræ is seventeen in *B. patachonica* and sixteen in *B. intermedia*. After these vertebræ there come in *B. patachonica* thirteen, and in *B. intermedia* sixteen caudal vertebræ, with free lower spines or hæmapophyses, the last of these spines being in both species open—that is to say, divided into two separate laminæ, larger in *B. patachonica* than in *B. intermedia*. At last, to the end of the tail, follow nine or ten vertebræ, successively smaller, of which, in both species, the last six have been lost. The fifty-eighth vertebra in *B. patachonica* has almost the same bulk as the fifty-ninth vertebra of *B. intermedia*, but is a little larger in the body; which permits us to suppose that the total number of vertebræ in the two species was not the same, but that *B. patachonica* had several vertebræ less than *B. intermedia*, although the last inferior spine is situated in both species on the same vertebra, *i. e.* the fifty-fourth. All these differences seem to me to indicate a specific difference in the two animals.

Of the fins only the shoulder-blade and the humerus have been preserved in the skeleton of *B. intermedia*, the sternum also is wanting; but in that of *B. patachonica* we have the fins almost quite complete, the smallest inner finger alone having been lost. The sternum also has been preserved: this has nearly the shape of the same bone in *B. physalus*; but the large central excision of the anterior portion is absent in our species, and in place of it there is a small hole in the centre of the same portion, which measures 17 inches in breadth, and the whole sternum 15 inches in length, the central aperture occupying 2¼ inches of this extension, and commencing 2½ inches behind the slightly excavated anterior margin. The narrow posterior portion of the sternum is 8 inches long and 5 inches broad at first, but 2½ at the end.

The shoulder-blade presents nothing of importance; it is 23 inches in height and 37⅓ at its greatest breadth. The humerus is 18 inches long; and each bone of the forearm is 25–26 inches in length, the cubitus above having behind a large salient angle. The pectoral fin is 6 feet in length and 18 inches in breadth at the beginning of the forearm, the projecting angle of the olecranon being occupied by a large, sharp, triangular cartilage. There are the usual five carpal bones, and in the terminal portion of the fin five fingers, as with all the *Balænopteræ*. In these fingers the first (external) one has four bones, namely one metacarpal and three phalanges, the four measuring 4½, 4, 3¾, and 3 inches in length. In the second finger, which is longer, there are six large bones and a small terminal point as indication of a seventh; these articulations are 5⅙, 5, 4, 2¾, 2, and 1½ inch in length. The third finger is but little shorter than the second, though somewhat longer than the first, and has the same bones as the second, though each one is rather smaller—4½, 4⅛, 3¼, 3, 2, and 1⅓ inch in length. The fourth finger (which ought to contain, according to analogy, one metacarpal bone and three phalanges, being the shortest of all) has been completely lost from both fins.

Of the bones at the side of the sexual aperture, corresponding to the bones of the pubis of the pelvis, one has been preserved, very similar to the same bone in *B. physalus*. It is slender and nearly a foot long, compressed and slightly arched, with a projecting and rather sharp angle on the upper margin, 3 inches above the termination. To conclude, the hyoid apparatus is composed of the three bones which are well known in all whales, of which the middle one much resembles the same bone figured in the work of Van Beneden and Gervais, pls. x. & xi. fig. 15; but the two lateral ones are not externally so bulky as those in the same figure. The central bone has a transverse length, measured in a straight line, of 26 inches; and each of the lateral processes is 15¼ inches long.

We have also the hyoidal apparatus of *B. intermedia*. It is a little larger; its middle portion measures 31 inches in length; and each anterior horn is somewhat larger in bulk though shorter, 14½ inches in length. In the middle portion the two angles at which the horns are united are shorter and more divergent; and the whole shape of the apparatus is slightly different from that of the other species. For the rest, I can affirm that not a single bone of the one skeleton is identical in shape or size with the corresponding bone of the other; and this proves clearly a specific difference between the two animals.

Unfortunately I am not acquainted with the sex of my skeleton of *B. patachonica* so as to certify definitely that the indicated differences are not sexual; but they appear to me of too great importance to admit this supposition. I have also under my notice the whalebone-plates of the two animals; but those of *B. intermedia* are too much destroyed for a complete description. Those of *B. patachonica* are composed of 350 laminæ on each side of the mouth, of which the 136 smaller ones at the end are all white, also the underside of the others, with the bristles of the whole; whereas the beards of the plates of *B. intermedia* are completely black, and there is no vestige of the whitish colour of the other species.

It follows from the explanation here given, according to my views, that there are actually three well-defined species different from the *Balænoptera* of our coast of the Atlantic Ocean, which are distinguished in the following manner:—

1. *B. intermedia.* The largest; 58 feet long, with a head 14 feet in length and 6 feet in breadth, and 8 feet high at the middle of the body; has the most robust figure, most bulky cranium; and its vertebræ number at least sixty-six (besides the sixty-one preserved there being five to six wanting), which number may be divided into seven cervical, fifteen dorsal, sixteen lumbar, and sixteen caudal with spines beneath.

2. *B. patachonica.* Rather smaller, although not shorter; but has a more slender figure and less bulky head, 5½ feet broad, although also 14 feet in length; of the fifty-eight and a half vertebræ preserved, seven are cervical, sixteen dorsal, seventeen lumbar, and thirteen caudal with under-spines, also wanting the five to six terminal vertebræ. This species is described in the 'Proc. Zool. Soc.' 1865, p. 191.

3. *B. bonaërensis.* The smallest, 30 to 32 feet in length, with a head 7 feet long and 4 feet wide, and a vertebral column of forty-eight vertebræ, divided into seven cervical, eleven dorsal, twelve lumbar, and eighteen caudal; but only the nine anterior have under-spines. The skeleton of this species was described by me in the 'Proc. Zool. Soc.' 1867, p. 707.

POSTSCRIPT.—In the description, instead of nine under-spines of the tail it should be twelve, as I have lately found three more bones on the skeleton, each open and composed of two separate pieces; the number of vertebræ is exactly the same as in the European species. Mr. Turner of Edinburgh is of Dr. Gray's opinion, and separates *Sibbaldius* from *Physalus*. I have seen the Ostend specimen of *Sibbaldius* at Leipsic, and cannot understand how M. van Beneden could unite this gigantic animal with the slender *Physalus*, which I know very well, from the daily inspection of the skeleton in the museum of Greifswald.

Buenos Ayres, H. B.
September 25, 1872.

LX.—*On some new Species of Reptiles and Fishes collected by J. Brenchley, Esq.* By Dr. ALBERT GÜNTHER, F.R.S.

THE following diagnoses are taken from an account of the reptiles and fishes collected by J. Brenchley, Esq., in Polynesia, the East Indies, and Central Asia, and kindly presented by him to the Trustees of the British Museum. This account, which contains more detailed descriptions, was prepared some time ago for a large work which Mr. Brenchley has in the press; but as the execution of the numerous plates with which the work will be illustrated may cause a further delay in its publication, I have thought it best to publish now the following shorter notices.

REPTILES.

Eremias Brenchleyi.

The supranasals meet, separating the præfrontals from the rostral; præfrontals not confluent; a small azygos shield between the postfrontals. Six upper labials in front of the infraocular, which forms a part of the free margin of the lip; the sixth labial only about half the size of the infraocular. Eyelid entirely scaly. Collar formed by eight scales, subequal in size. Ventral scutes forming thirty-one transverse and twelve longitudinal series. Præanal region covered with small scales. Fore limb reaching nearly to the extremity of the snout when stretched forwards; hind limb extending to the axil of the fore limb. Upper parts brownish olive, with an indistinct series of light-coloured ocelli on each side of the back; a well-defined whitish band commences behind the eye, passes through the tympanum, and runs along each side of the body to the axil of the hind leg. Hinder side of the thighs with a few whitish ocelli on a black ground.

A single adult female was obtained in Mongolia.

Eremias multiocellata.

The supranasals meet, separating the single præfrontal from the rostral; præfrontals confluent into a single shield; a small azygos shield between the postfrontals. Six upper labials in front of the infraocular, the narrow lower corner of which enters the free margin of the lip; the sixth labial as large as the infraocular. Eyelid entirely scaly. Collar formed by a central larger and numerous smaller lateral shields. Ventral scutes forming thirty transverse and eighteen longitudinal series. Præanal region covered with small scales. Fore limb reaching nearly the extremity of the snout when stretched forwards; hind limb extending to the axil of the fore limb. Greenish olive above, with numerous more or less perfect black rings enclosing a lighter centre. A somewhat irregular, whitish, black-edged band along each side of the body, from the eye to the axil of the hind limb.

A single specimen was obtained in the desert of Gobi, on the route from Sumé to the Tola river.

Euprepes haplorhinus.

This species would appear to represent a distinct generic division; but more than enough genera have been distinguished by names in the Scincoid family, and I am unwilling to increase their number without being fully convinced of the generic value of the distinctive characters.

This species, then, differs from *Euprepes* by lacking supranasal shields; it would be a *Mocoa*, but it has the scales distinctly provided with three or four keels.

The præfrontal forms a broad suture with the rostral as well as with the vertical. Only one fronto-parietal, notched behind to receive the front part of the central occipital. Vertical five-sided, nearly as long as broad. Nostril wide, in the centre of the nasal. Ear-opening with two or three short lobules in front. The middle of the body is surrounded by twenty-eight longitudinal series of scales, subequal in size; there are thirty-eight scales in a longitudinal series between the fore and hind legs. Six præanal scales, the middle of which are rather larger than the others. The fore leg extends to the middle of the eye if stretched forwards; third finger a little shorter than the fourth. The hind leg covers about two thirds of its distance from the fore leg; the fourth toe one fourth longer than the third.

With regard to coloration it is very similar to *Mocoa trilineata*. The dorsal parts are brownish, uniform or with dark markings more or less confluent into a pair of longitudinal bands. Sides black, with a well-defined white streak, one scale broad, from the tympanum, above the shoulder, to the axil of the hind leg. Lower parts uniform white.

Two examples from the Feejee Islands.

Mocoa micropus.

Præfrontal shield single, in contact with the rostral as well as with the parietal. Five occipitals, of which the central is as large as one of the anterior. Ear-opening very small, without any lobules. The middle of the body is surrounded by twenty-one longitudinal series of smooth scales; six series are dorsal and rather larger than the others. There are thirty-five scales in a longitudinal series between the axils of the fore and hind limbs. Four præanal scales, the two middle of which are twice the size of the lateral. Legs very feeble, but five-toed; the fore leg does not reach the ear-opening if stretched forwards; fingers very short, subequal in length; the third and fourth toes equal in length. Back light greenish olive, with a few minute black specks, bordered on the side by a deep-black band, which gradually passes into the greyish coloration of the lower parts; the latter are indistinctly marbled with whitish.

Two specimens, apparently young, from the Feejee Islands.

Hinulia tetragonurus.

The præfrontal forms a broad suture with the rostral as well as with the vertical. Vertical five-sided, much longer than broad.

Only one fronto-parietal, notched behind to receive the front part of the central occipital. Nostril in the centre of the nasal, with a lunate groove behind. Ear-opening without lobes in front. The middle of the body is surrounded by twenty-eight longitudinal series of scales, those on the back being rather larger than those on the sides and abdomen; there are forty scales in a longitudinal series between the fore and hind legs. Four præanal scales, subequal in size. *Tail strong, tetrahedral.* Legs feeble; the anterior extends to the ear-opening if stretched forwards; fingers very feeble and short; the hind leg covers about one half of its distance from the fore leg; the fourth toe one fourth longer than the third. Upper parts light brownish, finely marbled with darker, sides lighter; lower parts white.

One example, apparently adult, from the Feejee Islands.

NANNOSCINCUS (g. n. Scincid.).

Appears to be allied to *Cophoscincus* (Ptrs.), but differing by having keeled scales. Body of moderate proportions; legs feeble, five-toed. Eyelid narrow, scaly. No supranasal. Ear-opening externally not visible, entirely hidden by scales.

Nannoscincus fuscus.

Rostral shield depressed, flat, somewhat wedge-shaped. Præfrontal forming a broad suture with the rostral as well as with the vertical. Vertical much longer than broad, tapering behind. Four supraciliaries. Five occipitals, the middle of which is smaller than one of the anterior. Nasals rhomboid, with the anterior and posterior angles acute, perforated in the middle by the nostrils. Five or six supralabials. Scales with three or four keels, in twenty-two longitudinal series, the dorsal not being conspicuously larger than the lateral; there are thirty-eight transverse series of scales between the fore and hind legs. Four præanal scales, the middle being somewhat the larger. Anterior toes almost rudimentary; the third and fourth hind toes rather longer than the second. Upper parts uniform shining blackish brown; lower parts speckled with greyish.

One example from the Feejee Islands.

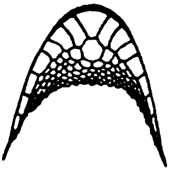
Gymnodactylus multicarinatus.

Snout broader than long. Head without any larger tubercles, except in the occipital and temporal regions. Six upper labials; the middle lower labial large, without mentalia, or with a pair of only rudimentary ones behind. Back with from sixteen to twenty regular longitudinal series of small conical tubercles; the series are equidistant from each other, and the tubercles are close to one another and ribbed. The abdominal scales are very small, strongly keeled, and gradually reduced to minute tubercles in the direction towards the vent. The tail in all our specimens is more or less reproduced and uniformly granular, without tubercles or scutes. The upperside of the hind limbs with scattered, strongly ribbed tubercles. No pores. Upper parts brownish uniform, or with dark transverse markings; sometimes a blackish streak from the eye to above the tympanum.

Several examples from the New Hebrides (Aneiteum) and Tongatabu.

Peripia cyclura.

Back uniform granular, without any tubercles. Scales in the middle of the belly in about forty-five longitudinal series. Tail rounded, not depressed, very narrowly verticillated, without enlarged subcaudals. Nine upper and eight lower labial shields. Front lower labial elongate; but the two adjoining labials are still longer; the chin is covered with very small shields, of which one in the centre, immediately behind the front labial, is generally the largest. Brownish grey above, with more or less irregular brown bands across the back, each band being ornamented with some small white spots; the brown bands are sometimes replaced by a dark marbling.



Twice nat. size.

Several specimens from New Caledonia, all agreeing in the peculiar pholidosis of the chin and in the form of the tail. The longest is 4¾ inches long, of which the tail takes 2 inches.

I have no doubt that Professor Peters is perfectly right in supposing that *Peripia Peronii* is identical with *Peropus mutilatus* of Wiegmann (Monatsber. Berl. Acad. 1867, p. 14).

FISHES.

Dicerobatis draco.

Teeth tessellated, those of the upper jaw in forty-six series, each tooth being much broader than long and trenchant behind. The band of teeth terminates laterally at a short distance from the angle of the mouth. Body and tail smooth. The distance between the mouth and dorsal fin is one half of the greatest width of the body. Tail more than twice as long as the disk, without spine. Upper parts uniform brown, top of the dorsal fin white.

Misol Island. Greatest width of the disk 15 inches; distance between the front margin of the head and dorsal fin 7½ inches.

Scolopsis xenochrous.

D. $\frac{10}{9}$. A. $\frac{3}{7}$. L. lat. 44. L. transv. 3½/14.

Allied to *Scolopsis ghanam*.

The height of the body is contained thrice in the total length (without caudal), the length of the head thrice and a third. The diameter of the eye is one third of the length of the head, and a little more than that of the snout, and equal to the width of the interorbital space. Infraorbital arch with two strong spines, one pointing forwards, the other backwards; two or three small denticulations below the strong spine. Præoperculum with the angle projecting. Dorsal spines rather strong, but less so than those of the anal fin; second and third anal spines nearly equal in strength and length. Brownish olive; a narrow pearl-coloured band along the uppermost dorsal series of scales; a large blackish-brown spot on the posterior part of the gill-cover. A broad silvery band, three scales broad, along the trunk below the lateral line; the anterior part of the band is crossed by a pair of short oblique brown streaks, the middle part with a brown spot on the base of each scale; the posterior portion uniform pearl-coloured. Præorbital with a narrow silvery band. Fins colourless.

Misol Island. Length 7 inches.

Cubiceps pauciradiatus.

D. 10 | $\frac{1}{17}$. A. $\frac{1}{14}$. L. lat. 50.

The height of the body is one fourth of the total length (without caudal), the length of the head two sevenths. Abdomen compressed into a ridge in front of the ventral fins, which are received into a groove of the posterior part of the abdomen. The diameter of the eye is equal to the width of the interorbital space and one third of the length of the head. Snout shorter than the eye. Jaws with a series of minute teeth. The vomer and tongue are armed with a long elliptical patch of very small obtuse teeth; no teeth on the palatine bones. Maxillary hidden below the præorbital, and extending to the front margin of the orbit. Humeral plate much developed, triangular. Pectoral fin very long, longer than the head, and extending to the vent; not quite thrice as long as the ventrals. Caudal fin forked nearly to the base; the lobes can overlap each other. Uniform brown; inside of the mouth and gill-cavity black.

Misol Island. Length 5⅜ inches.

Percis alboguttata.

D. 5 | 22. A. $\frac{1}{18}$. L. lat. 60. L. transv. 5/13.

The height of the body is contained six times and a half in the total length (without caudal), the length of the head thrice and a half. The width of the interorbital space is one third of the diameter of the eye, which is two sevenths of the length of the head, and not quite equal to the length of the snout. Lower jaw slightly projecting beyond the upper; the maxillary extends somewhat behind the vertical from the front margin of the orbit. Cheek covered with minute scales to below the middle of the eye. The fourth dorsal spine is rather longer than the third, and about twice as long as the fifth. The ventral fins reach to the vent; caudal truncated. Brownish olive, with a series of five small pearl-coloured spots on each side of the back, along the base of the dorsal fin; a series of indistinct brownish spots along the lower half of the side; caudal fin with a pair of brown spots on the base, the lower spot being followed by an ovate white spot. Fins without distinct markings.

Misol Island. Length 6 inches.

Salarias coronatus.

D. 12 | 20. A. 20.

The height of the body is contained six times in the total length (without caudal), the length of the head five times and a third. The forehead projects a little beyond the mouth. The supraciliary tentacle is about as long as the eye, and terminates in several fringes. Nuchal crest none. A pair of canine teeth in the lower jaw. Dorsal fin deeply notched. Pectoral nearly as long as the head. Flesh-coloured, with eight dark cross bands as broad as, or broader than, the interspaces, darkest on the edges. Back with scattered brownish-violet spots smaller than the pupil. Sides and upper surface of the head with small round yellow spots, a group on the crown of the head being placed in a circle. Throat with three brownish-violet cross bands. Vertical fins nearly immaculate; anal with a blackish margin; pectoral finely dotted with black.

Salomon Islands. Length 3$\frac{3}{8}$ inches.

Chœrops Brenchleyi.

D. $\frac{13}{7}$. A. $\frac{3}{9}$. L. lat. 28. L. transv. $\frac{3}{10}$.

The height of the body is equal to the length of the head, and one third of the total (without caudal). Head much longer than high; the depth of the præorbital is more than the width of the orbit. Scales on the cheek small, scarcely imbricate, in four series. Operculum terminating in a membranaceous flap behind. Posterior canine tooth present. Præoperculum not serrated. Reddish olive: a broad pearl-coloured band ascends obliquely from above the axil of the pectoral towards the origin of the soft dorsal; its upper half is surrounded by a broad brown margin, which is spread over the base of the last dorsal spines and anterior rays. Root of the pectoral silvery. No other markings in a preserved state.

Misol Island. Length 7½ inches.

Clupea pinguis.

B. 5. D. 17. A. 19. L. lat. 43. L. transv. 13.

The height of the body is one fifth of the total length (without caudal), the length of the head one fourth. Scales deciduous. Lower jaw but slightly projecting beyond the upper; maxillary extending to below the front margin of the eye. Teeth none. Snout longer than the eye, which is one fourth of the length of the head. Ventral fin inserted below the anterior third of the dorsal fin, the base of which is midway between the root of the caudal and the end of the snout. Caudal fin deeply forked. There are fourteen abdominal scutes behind the base of the ventrals. Back bluish green, sides silvery, both colours being sharply defined from each other.

Misol Island. Length 5 inches.

Ophichthys pinguis.

Teeth pointed, in a single series in the maxillary, mandible, and on the vomer. Head small, pointed, its length being contained five times and a half in the distance of the gill-opening from the vent. Eye about half the length of the snout, the cleft of the mouth extending considerably behind its hinder margin. Dorsal and anal fins low, nearly entirely hidden in a groove; the former commences somewhat in advance of the gill-opening. The length of the pectoral fin is about one third of that of the head. Reddish brown, with eight large broad black spots across the back of the trunk, and fifteen across the back of the tail; they extend downwards to the middle of the side. Head with numerous small round blackish spots. No other spots.

Salomon Islands. Length 16 inches, the tail being 9½ inches long.

Ophichthys filaria.

Allied to *O. longipinnis* and *O. Kirkii*, but distinguished from both by the considerably greater slenderness of the body, the depth of which is two ninths of the length of the head, whilst it is rather more than one third in those two species.

The length of the head is one tenth of the distance between the gill-opening and vent; tail almost as long as the body. Cleft of the mouth of moderate width, extending to some distance behind the eye, which is small, and somewhat nearer to the corner of the mouth than to the end of the snout. Snout pointed, more than twice as long as the eye, projecting beyond the mouth. Anterior nostril with a small tube; posterior on the inner side of the lip, below the front margin of the eye. Teeth pointed, uniserial. Gill-openings lateral. Pectoral fin reduced to a minute filament. The dorsal and anal are about half as high as the body, the former commencing midway between the gill-opening and the eye. Coloration uniform.

Misol Island. Length 24 inches, the tail being 11½ inches long; depth of the body 3 lines.

Ophichthys misolensis.

The length of the head is one seventh of the distance between the gill-opening and vent; tail as long as the body. The depth of the body is one third of the length of the head. Eye small, above the middle of the cleft of the mouth, which is of moderate width. Snout pointed, twice as long as the eye, projecting beyond the mouth. Anterior nostril with a very short tube; posterior on the inner side of the lip, below the front margin of the eye. Teeth equally small, pointed, uniserial. Gill-openings somewhat oblique, lateral. Pectoral fin none. Dorsal and anal fins low, the former commencing at a very short distance behind the gill-opening, the latter immediately behind the vent. Coloration uniform.

Misol Island. Length 11 inches.

LXI.—*On* Psammoperca *and* Cnidon. By Dr. A. Günther.

These two genera are identical; and the name *Psammoperca* given by Richardson in 1846 has the priority, the name *Cnidon* dating from the year 1849 (Müll. & Trosch. Hor. Ichthyol. Heft 3). The amended diagnosis of the genus will stand as follows:—

Seven branchiostegals. Pseudobranchiæ none. All the teeth villiform, in bands, without canine teeth; tongue with a small, ovate, rough patch. Operculum with a small spine; præoperculum with a strong spine at the angle, with the posterior edge serrated, and with the lower limb smooth and covered by membrane. Two dorsal fins, slightly continuous, the first with seven or eight strong spines, another being attached to the soft dorsal; three anal spines. Caudal rounded. Pectoral short, rounded. Scales rather large, finely ctenoid.

It is more difficult to come to a final decision as regards the specific affinity of *Psammoperca waigiensis* and *Cnidon chinensis.* The British Museum possesses now six examples:—

1. The typical example, stuffed, from Australia (9 inches).
2. A stuffed example from Victoria (7 inches).
3. An example in spirits from New South Wales (9 inches).
4. A stuffed example from Torres Straits (12 inches).
5. An example in spirits from Manila (10 inches); obtained by Dr. A. B. Meyer, and undoubtedly identical with *Cnidon chinensis.*
6. A dry skin, said to be from China, obtained from a dealer (10 inches long).

In all these specimens the formula of the fins is the same: the first dorsal has only seven spines, not eight [*], the eighth spine belonging to the second dorsal fin. In other respects nearly every one of the specimens shows certain peculiarities, so that no two agree perfectly with one another, not even those from South Australia; but I think these differences are so slight as not to allow of specific distinction. Thus the number of scales in the lateral line varies from forty-seven to fifty-five; the vertical fins are sometimes quite naked, sometimes more or less thinly covered with minute scales; the humerus has sometimes two short points behind, sometimes one of the points is slightly denticulated, sometimes the lower is absent altogether. There is only one point by which the Philippine specimen is somewhat more conspicuously distinguished; and that is the distinctly concave profile of the snout; but also in this respect it is approached by that of our Australian example which is preserved in spirits, although the concavity is so slight that it has been entirely effaced in the stuffed specimens.

Under these circumstances I am inclined to regard these fishes as specifically identical.

LXII.—*On the Structure of the Echinoidea.* By S. Lovén.

[Concluded from p. 385.]

The same arrangement that is expressed by the formula for the two series of the ambulacral peristomial plates, makes itself apparent also in the appearance of the sphæridia. In the Spatangidæ (for example, *Brissopsis lyrifera*) they first show themselves in the one-pored peristomial plate in each ambulacrum, quite close to the suture, and usually incline over towards the two-pored plate. While the peristome is still pentagonal, and the mouth only a very little removed from the middle of the buccal membrane, a sphæridium has appeared in the two-pored peristomial plate also in *Echinocardium ovatum*; but this is still much smaller than the first. Thus, even here, series I. *a*–V. *b* comes after series I. *b*–V. *a*. When the mouth has shifted its position so far backwards that it nearly touches the labrum, each ambulacrum shows a third sphæridium in plate 2 in series I. *b*–V. *a*; and when the mouth begins to be concealed by the projecting labrum, the fourth is added in plate 2 in series I. *a*–V. *b*, apparently first in the paired rows of the trivium. A very young *Cassidulus caribæarum*, 4 millims. in length, has already two sphæridia, the unequal size of which shows that of the one-pored peristomial plate to be the older one; when 7 millims. long it has four, all visible, in deep cavities. When it has reached a length of 12 millims., there are six sphæridia, but the overgrowth characteristic of this group has likewise commenced. An outer layer of shell-substance of irregularly reticulate texture, closely resembling a froth, spreads upon the surface of the test; it is seen most distinctly in the sternal region of the unpaired interradium, where it starts from the middle of each plate and extends over its margins in narrow, tortuous, irregular ridges, so as finally, in the adult, to form the uniform surface with small scattered holes which is peculiar to these genera. In the ambulacra this excrescent layer is first seen to raise the margins of the depressions in which the sphæridia are seated, thus forming a projection from them which gradually covers the sphæridia; and just as of each pair the first sphæridium makes its appearance in series I. *b*–V. *a*, so it is also this which in its order is first concealed, and afterwards that of series I. *a*–V. *b*, so that they are overgrown in the order of their appearance.

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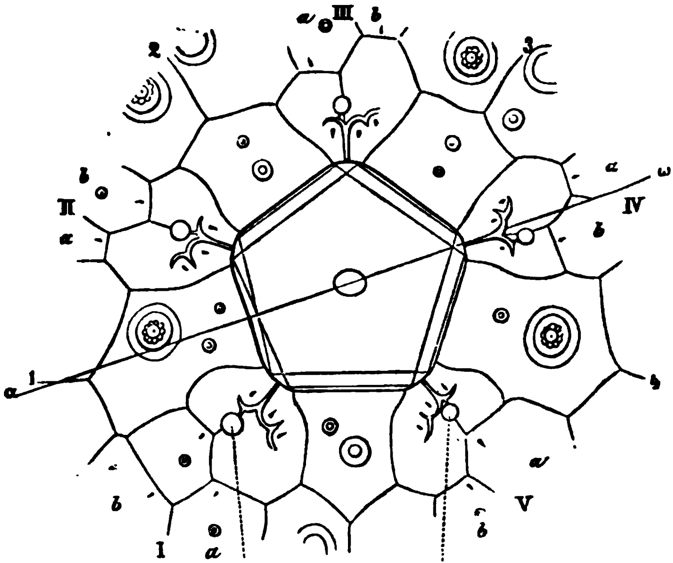
[*] What I have formerly (in dried specimens) taken for the spine of the second dorsal fin is, in fact, only the hardened first simple ray.

Toxopneustes dröbachensis again may show how the sphæridia appear in the Latistellæ (see Pl. XIV. figs. 1–8). An individual of 3 millims. (fig. 2) has two sphæridia in each ambulacrum:—one, the oldest, on the binary plate of the first primary plate of series I. *b*–V. *a*, near its margin; another on the ternary plate of series I. *a*–V. *b*. At the size of 6 millims. (fig. 3) their number is four; 1 stands still nearer the margin of its primary plate 1, and 2 as before, and two new ones have made their appearance—3 on the other primary plate of the binary large plate of series I. *b*–V. *a*, and 4 on the third primary plate (3) of the ternary of series I. *a*–V. *b*, which is an entire plate, not on 2, which is intermediate and a half plate. When the animal is a little more grown (fig. 4), it has also four sphæridia, not, however, 1, 2, 3, 4, but 2, 3, 4, 5. The binary large plate of series I. *b*–V. *a*, both primary plates of which have coalesced, has become depressed to a great extent; and its sphæridium, which was the first to appear and stood on the margin of its primary plate 1, has disappeared. Sphæridium 2 still remains, but, during the progress of the depression, has approached the margin; 3 stands, as before, on the binary large plate of series I. *b*–V. *a*, and 4 on the ternary plate of series I. *a*–V. *b*; and a new sphæridium has made its appearance on the primary plate 1 of large plate 2 of series I. *b*–V. *a*. These sphæridia, 2, 3, 4, 5, are still present after the large plates 1 and 2 of both series have coalesced into secondary large plates, and the animal has become 11 millims. in diameter (fig. 6). But in a somewhat larger animal of 15 millims. diameter (fig. 7), which has five sphæridia, these are not 2, 3, 4, 5, 6, but 3, 4, 5, 6, 7; for the sphæridium 2, gradually approaching the margin, has disappeared, a sphæridium, 6, has been added apparently on the primary plate 1 of large plate 2 in series I. *a*–V. *b*, and yet another, 7, apparently on the primary plate 1 of large plate 2 in series I. *b*–V. *a*. Finally, at the size of 52 millims. (fig. 8), when the ambulacral peristomial plates are large plates of the third order, consisting of 1, 2, and 3 united, their six sphæridia have the ordinal numbers 3, 4, 5, 6, 7, 8, the last of which apparently belongs to primary plate 1 of large plate 3. Thus by the resorption which takes place in the margin of the peristome, two sphæridia have been lost, and one radiole with its tubercle.

Thus *the asymmetry in the Echinoidean skeleton, with relation to its antero-posterior axis*, is expressed within each ambulacrum, in its two subordinate rows of plates, most strikingly in the arrangement, size, form, changes, and movements, during growth, of the peristomial plates and those immediately following them, in the number and position of their pores, in the order of the appearance and disappearance of the sphæridia; and it will probably not fail, upon closer investigation, in the relations of the radioles and pedicellariæ. In effect it abrogates the radiate plan of structure and displays the homologies between the Spatangidæ and Echinidæ, that even under the latter apparently radiate form we find in the bivium, which symmetrically encloses an unpaired interradium, a bilateral arrangement on the two sides of an antero-posterior axis, which is the same in the mature animal in all the different groups in the class.

If in the peristome of *Toxopneustes dröbachensis* (fig. 1, Plate XIV.), or of some other Echinid, we unite by straight lines the five plates I. *a*, II. *a*, III. *b*, IV. *a*, V. *b*, and the five, I. *b*, II. *b*, III. *a*, IV. *b*, V. *a*, two pentagons of the same size and form are inscribed in the circle, each of which has three approximated angles of equal size. These two pentagons are so placed that the side I. *a* V. *b* stands towards the unpaired interradium, and towards the madreporite's interradium the side II. *b* III. *a*, which is homologous with this,—that the four sides which in the two pentagons enclose angles of equal size but not homologous, are parallel two and two, but the sides which are common for the two unequal but homologous angles intersect each other,—and, moreover, so that the two pentagons together form with their outer lines a figure which is symmetrical, not in relation to that diameter of the stoma which coincides with the antero-posterior axis of the animal, but only in relation to a diameter, *a ω*, which passes through the point where the last-mentioned sides intersect each other, so that all lines which unite the homologous angles of the two pentagons (namely, IV. *a* with IV. *b*, III. *b* with V. *a*, V. *b* with III. *a*, I. *a* with II. *b*, and I. *b* with II. *a*) are reciprocally parallel and perpendicular to the same diameter—and that consequently, if one pentagon is turned round this diameter as upon an axis, it coincides with the other. In the same way we get two similar pentagons in the pentagonal peristome with rounded angles of

Fig. 3.



Buccal area in a young *Brissopsis lyrifera*: *sph.* sphæridia.

the young *Spatangus* (see fig. 3); and it is clear that this is the case also in the typically equally pentagonal peristome of the Clypeastridæ and Cassidulidæ. The diameter *a ω* passes, if produced, through ambulacrum IV. and interradium 1.

The interradia are rows of plates of the perisome, different from the ambulacra in growth and movement. If, by boiling in solution of soda, we carefully separate their plates in *Spatangus purpureus*, *Brissopsis lyrifera*, and *Echinocardium ovatum*, we find that many of them are furnished at their adoral angles with a semilunar lamella, which projects within the aboral margin of the preceding plate, which has a corresponding depression on its inner side. *Spatangus* has such a lamella on the third and fourth frontal and the third, fourth, and fifth lateral plates; *Brissopsis* on the third and fourth frontal and third, fourth, fifth, and sixth lateral plates in the hinder row; *Echinocardium* on the third lateral plate in the anterior row. No doubt the same is the case in many Spatangidæ, perhaps also in other irregular Echinoidea. This is an indication that the plates of the interradia are in some degree scales, although they never fulfil the same functions as the scales in the perisome of the Holothuriæ and Crinoidea.

The interradia in the Echinidæ are in a high degree mutually accordant; into the peristome of these they always enter with two plates, a large and a small one. It is generally only in young Echinidæ that the position of these can be observed. *Toxopneustes dröbachensis*, when young, constantly shows that if we mark the animal's right lateral interradium with 1, and consequently the unpaired one with 5, the smaller peristomial plate and the larger new-formed plate close to the vertical plate are found to belong to 1 *a*, 2 *a*, 3 *b*, 4 *a*, 5 *a*, and the larger peristomial and smaller new-formed plates to 1 *b*, 2 *b*, 3 *a*, 4 *b*, 5 *b*. It is the interradium 3, the left frontal of the animal, that changes the position of the plates (see fig. 1, Pl. XIV.). We find that such an arrangement is symmetrical on the two sides of a diameter passing through ambulacrum I. and interradium 3, the same that is the longitudinal axis in *Echinometra*, and in the vertical plane of which it has the curved line of its flexure.

Whilst in *Echinoneus* the interradia greatly resemble those of the Echinidæ in the forms and relative sizes of the plates, so that even the unpaired one, although perforated by the large periproctium, is still in a high degree in accordance with the paired ones, there is nevertheless a remarkable difference with respect to the peristomial plates, which is worth indicating in order that it may be carefully investigated in young individuals, like so many other things in that animal, such as the oblique mouth, &c. Interradia 1, 3, and 5 enter the peristome with a single plate, 2 and 4 with two plates; and if we reduce the peristome of *Echinoneus* to a circle, this arrangement also is symmetrical to the diameter which passes through ambulacrum I. and interradium 3. All other irregular Echinoidea have in each interradium only a single plate in the peristome. The arrangement of the interradia is symmetrical in relation to the animal's antero-posterior axis, which is also its longitudinal axis, and passes through the unpaired ambulacrum III. and the unpaired interradium 5—with a constant deviation in the Spatangidæ, without deviation in the Clypeastridæ and Cassidulidæ; whilst in these two families all the four paired interradia resemble each other in a high degree, the two frontal above all, and the two lateral are reciprocally perfectly symmetrical, and the unpaired interradium differs little from them, the plates being analogous in proportion and form, but cut out as if eroded for the periproctium, which is surrounded by the same plates during the whole life of the animal. This is the case in a high degree in *Laganum* and *Echinocyamus*, which have one of the youngest plates which pushes into the vertical plate large and pointed. So also in *Clypeaster*, *Stolonoclypus*, *Encope*, *Mellita*, *Echinarachnius*, and *Arachnoides*, in which the younger plates are gradually smaller and smaller, and those which lie close to the vertical plates small and of equal size, diverging and receiving the genital pores between them.

Much of all this is quite different in the Spatangidæ. The frontal interradia are symmetrical in all living genera; and between them and the lateral ones there is a considerable agreement. If the plates 2 in the frontals are very large, and the following ones very short, as in *Breynia*, *Lovenia*, *Eupatagus*, *Plagionotus*, *Maretia*, *Spatangus*, and *Echinocardium*, the same conditions occur in the lateral interradia; if the plates of the frontals approach a nearly equilateral pentagonal or hexagonal form, the same prevails in the laterals. But among themselves the lateral interradia are never alike, always unsymmetrical on both sides of the longitudinal line; and it is always the right lateral interradium, 1, that deviates. Those Spatangidæ, which seem to be most numerous among existing forms, but were very few during the earliest periods of the family, the *Prymnodesmii*, or those which have an infraanal fasciola and the most regular ambulacra, are also those in which this asymmetry is most strictly maintained. All their genera have in the right lateral interradium, in its hinder row, 1 *a*, one plate less than in the same row of the left one, 4 *b*; the first three plates of the right peristomial plate 1 and two following, represent the first four of the left lateral interradium, namely peristomial plate 1 and the three following 2, 3, 4. One of the three in interradium 1 *a* must therefore be regarded as composed of two plates; and it is clear that it is the second, which consequently should be indicated by 2+3; but both plate 1 and plate 4, and sometimes plate 5, assist in filling up the deficiency which occurs when the right 2+3 is not so large as the left 2 and 3 taken together. In most cases the former is as large as the two latter, as in *Brissopsis*, *Maretia*, *Lovenia*, *Eupatagus*, and *Echinocardium*; and in these, moreover, plate 4 is of equal size on both sides; in *Breynia*, *Plagionotus*, *Spatangus*, *Xanthobrissus*, *Micraster*, *Palæotropus*, and *Meoma* (which last has only a half infraanal fasciola) the plate 2+3 of the right side is somewhat less than the left 2 and 3 taken together; and then it is the right plate 4 in *Micraster*, *Echinocardium*, and *Palæotropus*, and with this also plate 1, and, in *Meoma*, plate 5, that is larger than the corresponding plate on the left side and fills up the deficiency. In *Brissus*, on both sides, plate 2 in 1 *b* and 4 *a*, is so large and so nearly equilaterally pentagonal that it presses away plate 2 in 1 *a* and 4 *b* from all contact with plate 1; and, moreover, plate 2 in 1 *b* is much larger than in 4 *a*, so that it makes up no small part of the measure that must be filled up in order to correspond with 2, 3, 4 in 4 *b*; here, also, 2+3 in 1 *a* is considerably less than 2 and 3 in 4 *b* taken together, and 4 in 1 *a* larger than 4 in 4 *b*.

The second group of Spatangidæ, which is now, so far as we know, less rich in generic forms, the *Prymnadeti*, those which are destitute of an infraanal fasciola, is far less regular as regards what is here in question. Five genera resemble many of the Prymnodesmii in this respect—that they have plate 2+3 in interradium 1 *a* of the right side equal in size to the left 2 and 3 taken together, and, moreover, plate 4 of equal size on both sides, as in *Agassizia* and *Schizaster*, or, as in *Mœra*, *Abatus*, and *Hemiaster*, plate 2+3 in 1 *a* smaller than 2 and 3 in 4 *b*, and therefore plates 1 and 4 of the right side, and in *Hemiaster* also 5, somewhat larger than on the left. But three other genera are very divergent. *Desoria* has plate 2 of interradium 1 *a* amalgamated, not with plate 3 in the same row, but with plate 2 in 1 *b*; and the same occurs in *Atrapus*; and in the former plate 2 in 4 *b* is besides separated from plate 1. *Palæostoma*, however, is the most divergent. Whilst all other Spatangidæ have, in each interradium, immediately after the peristomial plate 1, a pair of plates 2, this genus has plate 2 simple in both the frontal and lateral interradia; and, moreover, in interradium 1 it is not in 1 *a* that plates 2 and 3 are amalgamated, but in the row 1 *b*.

This is the diversity that the right interradium 1 shows in all known genera of recent Spatangidæ. It is quite clear that it is not the left side that has a plate more, but the right that has a plate less, and that here within a region not far from the peristome, but separated therefrom, the normal structure of the plates is disturbed. It is in the direction of this interradium that the diameter lies in relation to which the ambulacra are symmetrically disposed. Whether this diameter may possibly indicate the heterologous position which the Echinoderm, whilst still residing in its larva, had with regard to the latter, a primordial axis, from which it subsequently passed to another antero-posterior axis, or whether this abnormal coalescence of certain plates on one side of the animal may perhaps have some connexion with what takes place when the Echinoderm took up into itself the stomach and intestine of its larva, are questions which deserve to be borne in mind during further investigations upon the development of the Echinodermata, but which, for the present, we can only treat in a general way.

The unpaired interradium differs far more from the paired in the Spatangidæ than in the other irregular Echinoidea. It has a far more independent structure; and its dissimilar plates, which are essentially symmetrical, are differentiated for various functions. The first, or peristomial plate, which in the young is not very unlike those of the paired interradia, becomes developed into the labrum, with which the animal, during its movement forward in the soft sea-bottom, raises the mass of mud which constantly fills its intestinal canal. Behind the labrum follows the sternum, composed, like all the following segments, of two paired plates, furnished with powerfully movable, more or less oar-shaped radioles, with which the animal rows itself away; and behind the sternum the episternum and the long row of the abdominal plates, which are generally numerous, and which, in most of the existing genera, close at the madreporite, or, in *Hemiaster* and many extinct genera, are separated therefrom by eye-plates or vertical plates, when these close together behind the madreporite.

The labrum, in most, is very short, so that, with its outer margins, it occupies only the first 2-pored radial plate; in others, such as *Maretia*, *Lovenia*, *Breynia*, *Eupatagus*, *Atrapus*, and *Palæostoma*, it is so produced backward that it corresponds to the two or three first radial plates. The sternum presents, most distinctly in the Prymnodesmii, a certain correspondence with the plates 2 of the paired interradia, inasmuch as it is usually small when these are very large, as in *Breynia*, *Plagionotus*, *Eupatagus*, and *Lovenia*. Its relation to the bivium has already been mentioned. The plates of the episternum, in the same group, are narrowed or pointed backward; and their outer margin forms, with the outer margin of the first abdominal pair on each side, the *angulus episternalis*, into which the produced plates of the bivium project. This angle is very deep in *Eupatagus*, *Breynia*, *Plagionotus*, *Maretia*, *Echinocardium*, *Xanthobrissus*, and *Palæotropus*, and shallower in *Lovenia*, *Brissus*, *Meoma*, *Brissopsis*, and *Spatangus*. It is very small in the *Micraster* of the Chalk, in which it makes its earliest appearance, and which has the episternal plates still of nearly the same form as the other abdominal plates; this is also the condition in the Prymnadeti, in which all the posterior part of the unpaired interradium (*e. g.* in *Hemiaster*), by its uniformity, has a certain resemblance to the same part in the Cassidulidæ. This group of Spatangidæ also differs from the Prymnodesmii in that the plates of the unpaired interradium belonging to the left side are notably longer than those of the right side. Even the left sternal plate projects beyond the right one in most of them; if not, the episternum and all following segments are elongated. In *Palæostoma* this difference goes very far, inasmuch as the left plate of the episternum lies with nearly the whole of its length behind the right one, and all the following nearly in the same way. A consequence of this is a projection by which the periproctium, which here also is bounded, at least in front, by the same plates during the whole life of the animal, is not always symmetrically enchased—that is to say, that on one side a smaller number of plates attain its margin; and then it is always the left side that is furnished with a plate more than the right side. In general we may observe that in the Spatangidæ the left side is preponderant.

If we compare a very young *Brissopsis lyrifera*, 4·6 millims. in length, with a full-grown one, we find that the paired interradia in the former have already acquired their permanent form, only that the oldest plates (of the peristome) are comparatively broader, and plates 2 a little longer than in the full-grown specimen—and that in the frontals the small individual has eleven or ten plates, and the large one thirteen, two small plates having been added at the ends. In the laterals ten plates may be counted in both. The unpaired interradium has undergone far more change. The labrum and sternum are alike in both; the episternum in the small individual very short, its posterior margin very narrow; and the præanal plate, that which does not enter into the periproctium, and which changes most of all the plates of the test, is still three times as long as broad, while in the adult its length and breadth are nearly equal. In the latter there are 5–8 anal plates, in the young 5–9; the whole number of plates in the young is fourteen, in the adult fifteen.

It appears from this that the interradia in the Spatangidæ are enlarged principally by the growth of the individual plates, very little by the addition of new plates near the vertical plates. Every plate has a nucleus, which may often be recognized as its umbo, and is surrounded internally by the curves of growth.

If we examine a *Mellita hexapora* 6·5 millims. in length side by side with an adult of 85 millims., we find (besides the changes in the interradia of the ventral side, which are a consequence of the outgrowth of the ambulacra at their expense) that all the interradia in the small individual have from 9 to 10 plates, and in the large one 13 or perhaps 12; for it is scarcely possible to ascertain how far the plate through which the periphery passes is or is not divided into two by a suture. Here, also, the unpaired interradium is differentiated from the rest, although not so much as in *Brissopsis*. The hiatus ("lunula"), which occurs early in this interradium (all the others are situated in the ambulacra and have not yet made their appearance), is in the young nearly circular, in the adult long and narrow; and it shifts its position during growth, so that in the former it is bounded by the ventral plates 2 and 3, and by the dorsals 5, 6, and 7, but in the adult by the same ventrals (2 and 3) but by the dorsals 6, 7, and 8; the dorsals approach the margin, and there even, in some degree, become ventrals. The periproctium, which, like the stoma, is much larger in proportion in the young than in the adult, is round in the former and surrounded in front by a narrow margin of plate 2, which gradually disappears, so that finally plate 1 constitutes the anterior boundary of the aperture, which is oval in the adult. The circumstance that the number of pairs of plates in the interradia in the adult only in a slight degree exceeds that in the youngest, is not difficult to observe also in the Cassidulidæ and regular Echinidæ; whilst in all the augmentation within the ambulacra is far more considerable, and extraordinarily great in the petala of the Irregulares, in which it is greatly multiplied. We soon ascertain that in all Echinoidea the interradia and ambulacra grow and move independently, the former as the plated perisome, the latter as fixed arms.

In *Brissopsis* it is easy to see that the peripetalous fasciola strikes over the same interradial plate in the adult as in the young, over plates 4 and 5 in the frontals, 6 and 7 in the laterals, and over the tenth plate of the unpaired interradium; and it keeps in both to the same ambulacral plate in the bivium, namely the 14th or 15th, in the paired radii of the trivium to the ninth or tenth, but shifts, apparently, in the unpaired ambulacrum from plates 4 and 5 to plates 5 and 6. So also the infraanal fasciola passes in young and old over plate 3 of the unpaired interradium (the episternum) and its plates 4 and 5, and over plates 6, 7, 8, and 9 of the inner rows of the bivium. The fasciola consequently grows nearly equally with the plates of the test—but not perfectly; for it shifts a little on the plate within the limits of which it remains. On the inside of the test no indication of it is seen; it does not occupy an interspace between the plates of the test, but is entirely external, and belongs to a stratum of the test which lies without the radioli. For we see sometimes, *e. g.* in *Agassizia*, how, perfectly unaffected and entire, it covers groups of radiolar tubercles which are perfectly recognizable, as to form and arrangement, as through a piece of gauze, and in size are but little inferior to those of the same group which bear radioles immediately beyond its margin. Or we see, for example in *Plagionotus*, a crack in it; and through this the subjacent layer with its radiolar tubercles sticks forth. It has fractures which run transversely; during growth joints arise, when its close rows of tubercles change their direction; and sometimes such a joint coincides with the suture between subjacent plates, sometimes not, when the fasciola passes over it unaltered. Both the peripetalous and infraanal fascioles contain special forms of tentacles which do not overstep their boundaries. In *Brissopsis* the peripetalous fasciola contains, in the unpaired ambulacrum, the powerful tentacles with annular calcareous disks, and in the paired ones branchiæ; the infraanal constitutes the limit between the large tentacles wreathed with cirri, belonging to the inner rows of the bivium, which are produced so that their pores fall within its circle, and the simple, finger-shaped ones, which issue from the ambulacral plates of the sides. When we observe the entirely external position of the fasciola, how it glides over ready developed radiolar tubercles, how the most powerful external organs stand forth only within its circle, how in certain genera (such as *Plagionotus*, *Eupatagus*, and *Breynia*) the tubercles of the test, which on one side of the boundary indicated by it are small and but slightly developed, suddenly make their appearance of large size and strongly marked on the other side, and if we, moreover, note the opposition between the dissimilarity of the regions thus distinguished in the Spatangidæ, and the thorough uniformity in the Cidaridæ, Cassidulidæ, and *Echinoneus*, which have no fasciola, we are induced to ask whether a membrane, perhaps following the largest circumference of the test, may not cover the sides of the dorsal surface, and then, in some forms, check the development of the radioli, but beyond its border, which is the fasciola, leave two free fields for the outer organs and the hard structures of the test, one around the vertex and one infraanal. But this is of little consequence; the fasciola is still an unexplained organ. It has a border-line (" *Saumlinie* "), says Johannes Müller, comparable with the ciliary border of the larva in these respects, that it forms closed loops and produces an extremely brisk ciliary movement. Its satin-like close clavulæ of equal height, the shafts of which, and not the rounded and soft heads, are the vibratory organs, as was already observed by Johannes Müller, are in a high degree sensitive; and if a few of them are touched, many pass instantly into a common waving movement. With respect to the important question whether the Echinoderm has taken this over from its larva, and the membrane bounds it, it is worth remembering that the infraanal fasciola and the lateral (Desor) exclude each other.

On the dorsal surface, in all recent Echinoidea, the five ambulacra and the five interradia meet at a circle of five ocellar plates and, typically, five vertical plates. The latter have been called genital plates, because, in most cases, the efferent ducts of the genital glands have their external apertures, the genital pores, in them, and they have been regarded as belonging to the organs of reproduction. But they are no more a part of these than the plates of the unpaired interradium are a part of the nutritive organs because in the irregular Echinoidea the anus perforates them. It is easy to ascertain that the plates which have here hitherto been named vertical plates are present and ready formed in young individuals which are not yet fertile, and to observe how it is only at a later period, when the genital glands are matured, that their efferent ducts, oviducts, or *vasa deferentia*, perforate the plates from within. The madreporite, on the other hand, is commenced early during the larval state, and is undistinguishable from the vertical plates, while the genital pores in certain cases are distant from them. The greater the part occupied in the vertical plates by the aquiferous system, the smaller is that of the genital organs; and, *vice versâ*, when the former is small the latter is large. In the Spatangidæ the genital pore is wanting in the plate towards which the percolating apparatus spreads from its central region—so far, that of the normal five never more than four remain, in some not more than two. When, as in *Laganum*, the madreporite, which in some species of that genus opens into a ramified fissure, occupies the middle of the stellate ring, or, as in *Echinocyamus*, it consists only of a single pore, and when, besides, as in both these genera, the interradia close with one plate of the last pair very large and wedge-shaped, the genital pores in the vertical plates are situated near their margins; but when the madreporite is more widely expanded, so that it occupies the whole star of the vertex, they are placed between the vertical plates and the interradia, as in *Mellita*, or, as in *Clypeaster*, entirely in the latter and separated from the vertex by their last two or three plates. Cotteau long ago made the important observation that an Echinid also, namely *Goniopygus*, has the genital pores outside the vertical plates, near their apices*. But in all the Echinidæ every one of the five vertical plates bears its genital pore, and the madreporite is confined to one of them only, namely 2, the right anterior one. It cannot be doubted that the madreporite and sand-canal are carried to this position in this way—that the intestinal canal, which, in the irregular Echinoidea, has its anal orifice surrounded by the periproctium in the unpaired interradium and only in that, but there terminates at any point from the neighbourhood of the mouth till it cuts through the circle of the vertical and ocellar plates, opens in the Echinidæ in the middle of that circle, which closes round it. While the mouth, which opens earlier, has in all Echinoidea the same position with relation to the ambulacra and interradia, and its peristome independently formed regularly by the same plates fitted for the purpose and in a definite order, the anal aperture has a highly variable position, surrounded by eroded plates, in which it occupies during growth a gradually increased space.

In a young *Toxopneustes dröbachensis* of 5 millims. the vertical plates form a closed circuit, each over its interradium, and in their reentrant angles the five plates which bear the eyes are placed equally regularly. This is also the case in adult individuals of *Echinus*, *Sphærechinus*, and *Psammechinus*, and also in the Salenidæ. But in *Toxopneustes* and most others this primordial and normal arrangement is soon disturbed. The eye-plates of the bivium are gradually pushed into the circle on both sides of the vertical plate of the unpaired interradium 5, between this and 1 on the right side and 4 on the left. It is eye-plate I. that first reaches the inner circumference, and next eye-plate V., as in most genera, such as *Loxechinus*, *Lytechinus*, *Heliocidaris*, *Tripneustes*, *Boletia*, *Salmacis*, *Echinocidaris*, *Acrocladia*, and *Echinometra*; in *Amblypneustes* and *Mespilia* they come quite near it. Of the eye-plates of the trivium, IV. approaches the inner circumference, which it reaches in many; II. also approaches it, but in a less degree; and III., the eye-plate of the unpaired ambulacrum, is always distant from it. In *Diadema*, on the other hand, all the eye-plates are seen more or less completely to touch the anal membrane. This change of position depends, no doubt, upon the circumstance that the periproctium, by the resorption, especially, of the vertical plates 1 and 5 and by stretching, is enlarged more rapidly and strongly than the breadth of the vertical plates increases, and that the eye-plates, on which the growth of the ambulacra reacts as a *vis à tergo*, are driven into its median space. Vertical plate 2, which contains the madreporite, is enlarged more than the others, and keeps back eye-plates II. and III.

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* "Echinides fossiles du Département de la Sarthe," pp. 152, 154, pl. 26. fig. 2, and pl. 27. fig. 25; "Echinides fossiles du Département de l'Yonne," ii. p. 50, pl. 52. fig. 14: Bull. Soc. Géol. Fr. 2ᵉ sér. xvi. p. 162.

The anal aperture is produced in the same way in the Spatangidæ and Echinidæ. Quite young individuals of the former have the periproctium much more dorsal than older ones, as is the case in a high degree in a *Spatangus purpureus*, 2·025 millims. in length; this species is destitute of the peripetalous fasciola. So early as this the periproctium is nearly round, with the anus about in the middle. The anal membrane is closely covered with thin imbricated scales, which form circles:—the innermost one of long, narrow, pointed lamellæ, connivent around the anus; and around this one or more, consisting of larger triangular scales; the outermost a circle of still larger plates. Of these last, in many genera, the adoral grow preponderantly, so that the periproctium is gradually elongated, and the anus comes to be situated more excentrically in an aboral direction. It is otherwise in the Echinidæ.

In his memoir on the Echinoidea collected by Pourtales in the great depths between Florida and Cuba, Alexander Agassiz states that in a very early stage, when, however, the mouth with its jaws is already developed, "the anal system of the Echinidæ is limited to a single subanal plate, which makes its appearance before the genital and ocellar plates, and long remains more prominent than the other plates, which are added to complete the enlarged anal system"[*]. The pentagonal or somewhat rounded space which is enclosed by the five vertical plates is embraced at this stage by a single unpaired disk. Soon afterwards, in a young *Toxopneustes dröbachensis*, place begins to be prepared for the anus; but this occurs not in the middle of the disk, but excentrically and outside of it. The margins of vertical plates 1 and 5 are absorbed, and between them and the central disk an interspace is produced which is occupied by the soft general integument. In this is formed a pair of free, rounded, oblong, calcareous pieces, which do not coalesce with the disk. Whilst the periproctium enlarges so that it becomes oval in an oblique direction, and the disk is raised a little at its free margin, although it constantly remains attached by that opposite to vertical plate 3, another pair of rounded pieces appears in the enlarged interspace, and another near vertical plates 2 and 4; and, as many such are added, gradually becoming smaller and smaller, their number is greatly increased; while the original central disk, which itself does not grow much, is still long recognizable by its position and size. Finally the periproctium is eroded into a large oval aperture; the calcareous pieces which closely fill its covering membrane become very numerous, and the surrounding plates strongly eroded. The anal aperture, which is not completed until this augmentation of the calcareous pieces in the skin is considerably advanced, is always situated more or less excentrically in the apex of the membrane, which gradually rises conically, and normally in the direction of ambulacrum I.; and the oval periproctium generally has its longest diameter in the same direction from interradium 3 to ambulacrum I., the same that is the longitudinal axis of the test in *Echinometra*, and in relation to which the peristomial plates of the interradia are symmetrically arranged in the Latistellæ.

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[*] 'Contributions to the Fauna of the Gulf-stream' &c. pp. 281, 284, 285. From 'Memoirs of the American Academy,' ix. p. 12.

This formation of hard pieces of calcareous network occurring in the central space, within the circle of the vertical plates, and which, in the earliest stage, gives origin to a single disk, but afterwards, during growth, divides itself regularly into different centres for the production of numerous, free, smaller and smaller pieces, agreeing in their texture with the first disk—the whole of this structure, although in close connexion with the appearance of the anus, belongs nevertheless not to its development but to that of the dermal skeleton; and the complex of hard parts which originates therefrom is an independent part of the latter. It recurs in the Salenidæ, not early broken up into different small parts, but constant, coherent, and solid, in the pentagonal disk which here regularly occupies the central space. At the appearance of the anal tube it is partly eroded by absorption in its posterior margin, but still more the vertical plates lying behind, in *Heterosalenia* and *Salenia*, 1 and 5, in the normal direction towards ambulacrum I.,—in *Acrosalenia*, *Goniophorus*, and *Peltastes* only plate 5, as has been explained by Cotteau, who was the first that correctly oriented both these and all other forms of Echinidæ, in the manner here confirmed. In these genera it is not an added supernumerary plate, but a normal part of the skeleton, which in them retains during the whole life of the animal its original form but little altered by the intrusion of the anal tube; whilst in other Echinidæ it is very early changed into a flexible covering, or, as in *Diadema*, entirely disappears. It seems probable that careful investigations will show that this independent central disk may recur in the irregular Echinidæ in the median area of the vertex, which is penetrated by the madreporite, and in many of them (*Pygurus*, *Clypeus*, and others) is very large.

If we get rid of the notion that the vertical plates are an appendage of the generative organs and the central disk of the alimentary canal, if we see the latter in young Echinidæ in its original state, and consider, moreover, the vertex of the Salenidæ as being entire and not eroded from the periproctium, we obtain an arrangement of these parts of the skeleton the nearest homologue of which is to be sought in an Echinoderm of a class which is regarded as very distinct from the Echinoidea. The *Marsupites*, only known as fossil, a Crinoid without a peduncle, has in the pole opposite to the mouth a single pentagonal disk closely embraced by the five basalia. It is the same arrangement as that of the vertex in the young of *Echinus* and in the Salenidæ. The central disk and the basalia, with the rest of the plates in *Marsupites*, have striæ or grooves which are perpendicular to the suture, and may be traced up to the middle of the plate, and make their appearance most distinctly when its outermost calcareous layer is eaten away. But this character is no peculiarity of *Marsupites* or of the numerous Crinoidea in which it occurs. If we carefully examine the central disk and vertical plates in small Echinidæ, we find exactly the same structure. It may be discerned even on the surface by direct light, but is exceedingly distinct by transmitted light and suitable treatment. We see the pentagonal plate divided into five triangular areas, which have its five sides for their bases, their apices united in its middle; the reticulated texture is arranged, in each area, so that straight parallel rods perpendicular to the base have narrow interspaces between them. In the middle of the plate the rods and interspaces of the different areas meet together and unite, crossing each other in a closed and apparently irregular network; but in the sutures those of one plate are seen to meet those of another in the same direction. This structure recurs in all plates in the Echinoidea, whether regular or irregular, and is the same that has long been known in the Cystidea. In the fossil Salenidæ these striæ are seen very generally; and the structure of parallel rods in the interior is very distinct in a living *Salenia* from the great depths near the Antilles, for which, as for a *Pygaster* from the same depths, and numerous other valuable objects, our Royal Museum is indebted to Dr. Axel Goës's conscientious and indefatigable researches.

Another trait which expresses the homology between the base of *Marsupites* and the vertex of the Salenidæ is to be found in the elevated ridges which in both unite the middle points of the plates; and the strongly developed vertical plates of the Salenidæ scarcely present any "sculpture" which does not recur in a similar form in the Crinoidea.

Now, since the central disk in the young Echinidæ and in the Salenidæ is to be regarded as homologous with that of *Marsupites*, the five plates which embrace it, and which here are called vertical plates, but have hitherto borne the name of genital plates, are *ipso facto* to be interpreted as basal pieces (basalia), and the "eye-plates" in their reentrant angles as radial pieces (radialia). A calyx is present in its essential parts, homologous, by its position at the pole opposite to the mouth, its constitution, and its structure, with that of the Crinoidea. But since the Echinoidea are free animals which turn their mouth towards the surface whence it takes its food, the calyx comes to be the vertex of the dermal skeleton instead of its base. It receives the newly formed plates of the corona, the basalia meeting the growing ends of the interradia, and the radialia those of the ambulacra. In the Echinidæ which have their anal aperture where the peduncle of the Crinoidea is attached, the calyx is normal and recognizable in its form; in the Clypeastridæ it is most frequently entirely penetrated by the madreporite, which effaces the sutures of the pieces; and in the irregular forms with an elongated antero-posterior axis and a developed bivium (*Echinoneus*, Cassidulidæ, and Spatangidæ) it becomes entirely abnormal, and, in the Collyritidæ, during the Jurassic and Cretaceous periods, was broken up, so that the two radialia which meet the bivium were separated from it by the perisome. But it is not absent from any form of Echinoidea.

The investigations which are here communicated will, it is hoped, speedily appear in a more detailed form, illustrated by a selection from numerous figures carefully prepared by M. A. M. Westergren.

EXPLANATION OF PLATE XIV.

Fig. 1. A young *Toxopneustes dröbachensis* of 4 millims., spread out from the peristome. I., II., III., IV., V., ambulacra; 1, 2, 3, 4, 5, interradia. In the middle the mouth with the teeth; around this, in the buccal membrane, ten free pore-plates, two for each ambulacrum, of which the five which lie before I. *a*, II. *a*, III. *b*, IV. *a*, V. *b* are perceptibly larger than the others. Peristomial plates I. *a*–V. *b* and I. *b*–V. *a* are united by straight lines; and by this means two pentagons are inscribed in the circular stoma, symmetrical only in relation to the diameter *a ω*. The plates of the vertex kept together, upon interradium 2 (where the madreporite has its place), with the central disk, *d*, *c*. The inner circle, already enlarged and elongated in the direction of ambulacrum I. by the absorption of the vertical plates 1 and 5 at their inner margins; in the interspace small pieces of calcareous network show themselves. The verticals are not yet perforated by the genital pores. Of the eye-plates, I. has already pressed in between 1 and 5, and II. approaches the inner circle.

Figs. 2–8. *Toxopneustes dröbachensis.* Ambulacrum III., to show its changes during growth. 1, 2, 3, &c., primary plates and tentacular pores; 1, 2, 3, &c., large plates; 1, 2, 3, &c., sphæridia; 1, 2, 3, radiolar tubercles.

Fig. 2. Young of 3 millims. The tentacular pores still in nearly unaltered primordial curves. Two sphæridia.

Fig. 3. Young of 6 millims. The tentacular pores already distinctly arranged in secondary curves. Four sphæridia, 1, 2, 3, 4. The peristomial plates depressed. The radiolar tubercle 1 in *a* 1 much diminished.

Fig. 4. Young, somewhat larger. The peristomial plates more depressed; in *a* 1 the two primary plates have coalesced. Sphæridium 1 has disappeared, and 5 has been added. Radiolar tubercle 1 in *a* very small, that in *b* diminished.

Fig. 5. Young, somewhat larger still. In *a*, large plates 1 and 2 have coalesced to form a binary peristomial plate; in *b* the sutures of the primary plates have disappeared. Radiolar tubercle 1 in *a* 1 lost, in *b* 1 diminished.

Fig. 6. Young of 11 millims. diameter. In this, as in the following, large plate 3 in *a* has only three primary plates. Large plates 1 and 2 coalesced into a binary plate, also in *b*. Radiolar tubercle 1 has disappeared both in *a* and *b*.

Fig. 7. Young individual of 15 millims. The binary large plates 1+2 in both rows depressed. Sphæridium 2 has disappeared, and 6 and 7 have been added. Radiolar tubercle 2 diminished.

Fig. 8. Adult individual, of 52 millims. diameter. Large plates 1, 2, and 3 in both rows have coalesced to form ternary peristomial plates. One sphæridium, 8, added. In *b* there is still, apparently, a residue of radiolar tubercle 1.

Fig. 9. Stoma of a very young *Toxopneustes dröbachensis* of 2 millims. diameter. Of the free plates in the buccal membrane those which belong to I. *a*, II. *a*, III. *b*, IV. *a*, V. *b*, have not yet acquired pores. One sphæridium in each ambulacrum in I. *b*–V. *a*.

Fig. 10. Young of some northern Echinide, 0·6 millim. in diameter, from the ventral side. The pigment-spots are omitted, and the radioli only partially represented. No remains of the larva; no trace of jaws; no mouth or anus. Five large primordial tentacles, which, according to Krohn, soon disappear. Within these five pairs of smaller permanent tentacles, each of which stands over a disk of calcareous network, the first primary plates in the ambulacra. Outside of and between the pairs of these there are other disks, probably the foundations of the interradia. From an individual preserved in spirit.

Fig. 11. One of the large primordial tentacles with its disk, and in the latter a ring of calcareous net. In the wall of the tube longitudinal and transverse muscular fibres.

Fig. 12. One of the smaller permanent tentacles in the young animal, fig. 10, with its disk and a portion of the calcareous net which lies beneath its base.

Fig. 13. The oblong, externally pointed opening in the calcareous network, the pore, over which the tentacle stands.

LXIII.—*On the Guémul* (Huamela leucotis).

By Dr. J. E. Gray, F.R.S. &c.

Mr. Bates has kindly sent to the British Museum the skins of a male and of a female Guémul, forwarded to the Geographical Society by Don Henrique M. Simpson, who observes:—"These deer were encountered in a valley through the Cordilleras in lat. 46° S. There is only one other specimen known in Chili, in the Santiago Museum, which was found in lat. 35° S."

The skins sent are in winter fur, consisting of "quills" like those of the roebuck. They agree with the female animal which the Earl of Derby sent to the Zoological Society in 1849, and which was obtained by him from Valparaiso, from whence it was brought by "Don Benjamin Munoz, a Commodore in the Chilian navy; the animal was shot by one of the Chileno officers about 20 leagues from Port Famine, in the Straits of Magellan." I described and figured this animal under the name of *Capreolus leucotis* (Proc. Zool. Soc. 1849, p. 64, t. xii.). The male now sent has very peculiar horns, showing that it is different from any South-American deer hitherto existing in European museums; it is also characterized by the length and acuteness of its face. The horns are nearly erect, and somewhat like the horns of the fawn of *Cervus elaphus*, with a conical subbasal anterior branch. The beam is about the length of the head, quite simple, and tapering to a point; the front of the right horn is keeled, and rather below the middle there is a compressed tubercle, probably indicating a branch in the adult state; but there is no appearance of this on the other horn. It forms a genus distinct from any other, which may bear the name of *Huamela leucotis*; it differs from all the other Guazus in having a nearly basal frontal snag to the horns.

The Guémul or Huamel (*Equus bisulcus* of Molina, 'Hist. Nat. de Chili,' p. 303) has been a great puzzle to zoologists, and has been very imperfecrly described by Molina, who observes that it is "the unknown animal found by Captain Wallis in the Straits of Magellan (Hawkesworth, Voy. tom. i. cap. 2, p. 28)."

The rediscovery of the Guémul in its original country is of considerable importance, as there has been great confusion about it. It is quite distinct from and at least one third larger than the *Xenelaphus leucotis* brought from Tinta in South Peru, by Mr. Whitely, Jun., of which we have fine specimens in the British Museum, and which I formerly thought might be the Guémul; it must now be called *Xenelaphus anomalocera.* The specimens of the latter animal are covered with paler and thinner quills; but this appears to be the summer coat, and in the adult male there are patches of a darker colour and of thicker quills, indicating the coming of the winter coat.

This species differs from the Guémul in having, at least in summer, pale haunches and whitish legs. We have in the British Museum the imperfect skin in winter fur of a female, which Admiral Thornby, the brother-in-law of the Earl of Derby, brought from the coast of Chili in 1849. I have hitherto considered it a specimen of the Guémul; but it has much more whitish on the rump and abdomen. It may be the winter coat of *Xenelaphus anomalocera*, or a third species of South-American deer.

The South-American deer called Guazus are *Blastocerus paludosus* from Brazil and Paraguay, *Furcifer antisiensis* and *Xenelaphus anomalocera* (*X. leucotis*, Gray, Cat. Ruminant Mammalia, p. 89) from the Bolivian or Peruvian Alps, *Blastocerus campestris* and *Huamela leucotis* from Patagonia.

LXIV.—*On* Crinodes Sommeri *and* Tarsolepis remicauda, *in answer to Mr. Butler's Remarks.* By C. Ritsema.

In the 'Annals' of last October Mr. Butler rejects my opinion concerning the synonymy of the above-named moths.

It is, however, clear that the author, when he drew up the description of Mr. Cornthwaite's insect, was totally unacquainted with Hübner's *Crino Sommeri*, and that it was only after he saw my synonymic note that he compared the new (?) moth with Hübner's figures, and endeavoured to find some differences which might justify him in retaining his names. Why otherwise did he not mention this very similar moth, or indicate the supposed generic and specific differences when describing the new one?

In the following lines I will refute the arguments used.

Mr. Butler considers *Crino Beschei* the type of the genus *Crino*, because this species is figured before *C. Sommeri*. But, if we pay attention to the characters ascribed by Hübner ('Verzeichniss bekannter Schmetterlinge,' p. 216) to this genus ("Schwingen blass-sehnig, dunkelstriemig, mit glänzend weissen Flecken geziert"), we shall see that this lepidopterist really had in view the species called by him *C. Sommeri*, and that this description, without any modification, applies to Butler's *Tarsolepis remicauda*. With respect to *C. Beschei* it is clear that Hübner was not attached to the so-called type-system, and consequently we have nothing to do here with the last-named species. There is no doubt that *Tarsolepis remicauda* ought to be transferred into the genus *Crino*, Hübner, = *Crinodes*, Herrich-Schäffer.

Whilst Mr. Butler believes that Hübner's figure is really a representation of a male insect, as possessing a well-developed anal tuft of radiating scales (this character, however, occurs also in the Javan females, and is therefore without value), I rather believe it to be a female, on account of the feebly pectinated antennæ. The anal tuft, as covering entirely the sexual organs, may have been the cause of Hübner's mistake; in such cases only the examination of the retinaculum will furnish certainty concerning the sex of the moth.

The want of the two long tufts of carmine hairs at the base of the abdomen most probably must be ascribed to the sex, such tufts being almost confined (at this moment I do not recollect an example of the contrary) to the male insect; they are often totally hidden, as probably is the case with the male in Mr. Snellen's collection.

As regards the length of the palpi, I notice that the females I examined agree in this respect with Hübner's figures, and that Mr. Snellen's specimen (♂) holds the middle between Hübner's and Butler's.

No importance can be attached to the size of the abdomen and to its spinous processes as figured by Hübner, the former depending chiefly upon the sex and the state of desiccation, the latter, formed by some diverging long scales on the sides of the abdomen, occurring also in Mr. Snellen's male. Moreover it is incomprehensible to me how Mr. Butler can regard these processes as a *generic* difference, although nothing of the kind is to be seen in the representation of *Crino Beschei*, the species which, according to Butler, should be the type of the genus *Crino.*

The specific differences summed up by Butler must certainly be ascribed to a great extent to inaccuracies of the artist. In order to prove this it may be sufficient to notice the inner margin of the front wings in both Hübner's figures, which is waved only in fig. 1, and also the hind wings of the same figure, which are unlike one another. Moreover Hübner's figures are coloured too dark, and have almost all the markings (the pale basal patches excepted) defined too sharply, instead of the underside of the wings only, as Mr. Butler states; as for the latter, this author inclines to the contrary.

In the specimens I examined, the pale costal band does not quite extend to the apex and is broader than in Butler's figure, especially at the base of the wings; the central marginal line of the hind wings is continued round the margin, but, at the upper and underside, converted into spots as in Hübner's fig. 2; the transverse band of the front wings is strongly waved and not nearly parallel to the outer margin, whilst the fringe of all the wings is tolerably long.

For these reasons I persist in my assertion that Butler's *Tarsolepis remicauda* is identical, generically as well as specifically, with Hübner's *Crinodes Sommeri*.

After all, I may remark that it is not *impossible* that *C. Sommeri* occurs also in the New World*, although I rather believe it to be a mistake—just as seems to be the case with *Hemeroblemma peropaca*, which, according to Hübner ('Zuträge zur Sammlung exotischer Schmetterlinge,' No. 271, figs. 541 & 542), is from Monte Video, but has since been sent over from Sumatra, Java, Ternate (coll. Royal Mus. Leyden), and Celebes (Mr. Suellen's coll.), and also, with *Ophiusa magica*, received by Dr. Boisduval from Madagascar and Bengal ('Faune Entomologique de Madagascar, Bourbon et Maurice,' Lepidoptères, p. 100), and by the Royal Museum of Leyden from Java, and not from Monte Video as stated by Hübner (Zuträge &c., No. 268, figs. 535 & 536).

Leyden, November 1872.

LXV.—*On the Habits and Distribution of* Lycosa ingens (*Bl.*).

By the Rev. O. P. Cambridge, M.A., C.M.Z.S.

Accounts of the habits of spiders must always be interesting to arachnologists, and especially important to those who may themselves be unable to see their objects of study in a living state. The question, therefore, now raised (not for the first time†) by Mr. F. Pollock's account (Ann. Nat. Hist., Oct. 1872, p. 271) of the habits of *Lycosa ingens* (Bl.) is one on which, as an arachnologist, I should wish to have some clearer and more detailed evidence. I allude to the possibility of a spider swallowing solid matter; in the instance recorded by Mr. Pollock the solid matter consisted of the "bones, and head, and claws and all" of a lizard 3 inches long, "the only remnant of the feast being a small ball about ¼ of an inch in diameter."

My own impression has always been that no arachnid could do more than swallow the juices of its prey, or at most such other parts as could be so completely comminuted by the action of the fangs, falces, and maxillæ as to be enabled to pass in a kind of semifluid state through the simple but very small passage to the stomach. Did Mr. Pollock's spider thus comminute the "bones, head and all" of the lizard, except that small portion represented by the ball of a quarter of an inch in diameter? This is a point which it would be both important and interesting to have confirmed by more detailed and special observation.

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* I am informed (October 14th, 1872) by Mr. Walker that at present he has no opportunity of inspecting the specimen from Rio Janeiro, mentioned in the 'List of the Specimens of Lepidopterous Insects in the Collection of the British Museum' (*l. c.*), because it is no longer in Mr. Fry's collection.

† *Vide* 'Entomologist' for June 1870, No. 77, pp. 65–67.

Lycosa ingens must indeed have great power; it is the largest known spider of the *Tarantula* group; an adult female in my own collection (from Porto Santo) measures 1⅜ inch in length, exclusive of the legs and palpi; the male, however, is much smaller. If Mr. Pollock's example was an adult female, the length of its body and that of the body of the lizard (exclusive of the tail) would be about equal, so that the easy and speedy demolition of the lizard need not excite surprise.

Another observation of Mr. Pollock, and one upon which he grounds a strong and (if sound) an interesting generalization, is that each of the three islands of Madeira, Porto Santo, and Deserta Grande has its "own peculiar large *Lycosa*, no two being alike; and (Mr. Pollock continues) it is a very remarkable fact that these *Lycosæ* vary in size inversely with the magnitude of the island in which they are found,—Madeira, the largest island, having the smallest *Lycosa*, and Deserta Grande, the smallest island, having by far the largest spider." It would be important to know what were the range and extent of the observations upon which this is stated; the already published facts respecting the localities frequented by *Lycosa ingens* are certainly at variance with it. Mr. Blackwall states (Ann. Nat. Hist., Sept. 1867) that he had received both sexes of this species *from all three of those islands*; the same author (Ann. Nat. Hist. ser. 2, xx. p. 284) also states that he had received another almost equally large species, *Lycosa tarantuloides maderiana* (Walck.), from Porto Santo; and I have in my collection examples of this same species from that island. It would therefore surprise me very much to find that any careful and at all extended search should confirm Mr. Pollock's conclusion that these three islands, so apparently derived from a common origin and so near to each other, should be yet so capricious in respect of the distribution of their *Lycosæ*.

Bloxworth, November 16, 1872.

LXVI.—*Notice of a large Siluroid from the Upper Amazons.* By Dr. ALBERT GÜNTHER.

THE Trustees of the British Museum have recently purchased a very large specimen of a Siluroid from the river Huallaga, Upper Amazons; it had been captured by B. La Mert, Esq., who adopted the best method of preparing such large specimens, by having it carefully skinned, the fins and head remaining intact and attached to the skin, and then packing it in spirits of wine, which had to be changed twice, in a cask of suitable size. The specimen arrived in very good condition, and is now stuffed and mounted.

It belongs to a species apparently allied to *Platystoma truncatum*, but differing in the width of the bands of teeth in the upper jaw and palate; moreover it has the barbels much shorter than any of the other known species. I propose to name it

Platystoma gigas.

D. 1/6. A. 11. The upper jaw projects conspicuously beyond the lower. The length of the head is contained thrice and two thirds in the total length (without caudal). Head covered with skin; maxillary barbels much shorter than the head, mandibulary barbels still shorter. The intermaxillary band of teeth is rather broader than the vomerine portion of the band on the palate, which has a crescentic form; the intermaxillary and palatine bands are separated from each other by a very narrow interspace. The dorsal fin commences midway between the end of the snout and the origin of the adipose fin, and its first ray is rather feeble; the length of the adipose fin equals that of the anal. Caudal deeply forked. Colour of a uniform greyish brown, darker above than below.

	ft.	in.
Total length	6	6
Length of head	1	6
„ snout (from the eye)	0	8
Distance between the eyes	0	5½

LXVII.—*Description of some new Species of Birds in the National Collection.* By R. Bowdler Sharpe, F.L.S., F.Z.S., &c., Senior Assistant, Zoological Department, British Museum.

Family Paridæ.

Subfamily *Sittinæ.*

Sitta tephronota, n. sp.

S. similis *S. Neumayeri*, sed rostro longiore, coloribus conspicue pallidioribus, et linea nigra per oculum ducta usque ad interscapulium extensa distinguenda.

The large Nuthatch from Central Asia appears to me to be worthy of specific separation from the typical *S. Neumayeri* of Europe (*S. syriaca*, Ehr.). In the 'Birds of Europe,' Mr. Dresser and myself examined a bird from Kokand, which differed extraordinarily in size from the typical Grecian and

Palestine specimens. I do not think, however, that the species will rest so much on the larger dimensions, as they seem to be very variable, as upon the clear pale grey coloration and the pronounced elongation of the black eye-stripe. Two specimens from Candahar in the National Collection appear to belong to the eastern form. The comparative measurement of the Kokand example with another of the true *S. Neumayeri* gave me the following results:—

	Long. tot.	culm.	alæ.	caudæ.	tarsi.
S. Neumayeri	5·6	0·75	2·9	1·85	0·9
S. tephronota	6·0	1·0	3·5	2·1	1·05

Family **Muscicapidæ.**

Diaphorophyia Blissetti, n. sp.

D. supra saturate cinereus, vix viridi lavatus: tectricibus alarum remigibusque nigricantibus, extus viridi-cinereo marginatis: cauda supra metallice viridi, subtus nigricante: genis et regione parotica læte castaneis, plagam conspicuam triquetram formantibus: gula sordide at metallice viridi: corpore reliquo subtus pure albo, lateribus fuscescentibus nigro striolate lavatis: caruncula conspicua orbitali erecta scarlatina: rostro nigro: pedibus saturate brunneis.

Hab. Gold Coast. Presented by Andrew Swanzy, Esq.

Of this beautiful little Flycatcher I have another specimen, in my own collection of African birds, which is apparently the adult male; it differs from the one above described in having a dark metallic green back. This bird was sent to me by my friend Mr. H. F. Blissett, who procured it on the Gold Coast, in the province of Wassaw; and I have great pleasure in offering him a public acknowledgment for the aid he has rendered me by collecting birds in Western Africa.

Family **Timaliidæ.**

Trichastoma rufipennis, n. sp.

T. similis *T. fulvescenti* (Cass.), sed multo minor, et pileo brunneo, dorso rufescente lavato, remigibus extus sordide castaneis distinguenda. Long. tota 5·3 poll. Angl., culm. 0·55, alæ 2·45, caudæ 2·3, tarsi 1·0.

Hab. Gaboon. Collected by Mr. Paul Du Chaillu.

There can be no doubt, as Lord Walden some time ago pointed out to me, that the genera *Illadopsis* of Heine and *Trichastoma* of Blyth are identical; and the other African species are *Trichastoma fulvescens* (Cass.) and *T. gularis* (Sharpe). The present species is distinguished from both these last-named birds by its small size and red wings.

LXVIII.—*Descriptions of three new Species of Humming-birds.* By JOHN GOULD, F.R.S. &c.

Iolæma Whitelyana. (Whitely's Humming-bird.)

Male. Crown, all the upper surface, and flanks deep grass-green; an obscure glittering mark on the forehead; chin, chest, and centre of the abdomen jet-black, with a broad gorget of beautiful violet on the throat; the bill, which is stout and straight, is black, as are also the legs and toes; the tail and the under tail-coverts steel-black; primaries and secondaries purplish brown, the external edge of the outer primary reddish brown.

Total length 5¼ inches; bill 1⅛, wing 3, tail 2¼.

Hab. Cosnipata, province of Cusco, in the Peruvian Andes.

Remark. About the size of *Iolæma Schreibersii* and *I. frontalis*, but distinguished from both those species by its black chest.

I have great pleasure in naming this fine humming-bird after Mr. Henry Whitely, who is at this moment energetically searching for novelties pertaining to this beautiful family of birds in the more remote provinces of Peru. The specimen above described was obtained in August 1871 at Cosnipata, at an elevation of 2300 feet.

Adelomyia chlorospila.

Male. Crown and upper surface bronzy green, the feathers of the crown and upper tail-coverts greener than those of the back; over and behind the eye and curving downwards on the sides of the neck a somewhat conspicuous streak of buffy white; ear-coverts blackish brown; throat, chest, and centre of the abdomen buffy white, the feathers of the throat punctated with glittering green; flanks bronzy buff; under tail-coverts the same, but lighter; tail bronzy brown, all the feathers conspicuously tipped with fawn-colour; bill blackish brown, inclining to yellow beneath; legs and toes brown, the soles of the latter inclining to yellow; wings purplish brown.

Total length 3½ inches; bill $\frac{11}{16}$, wing $2\frac{1}{16}$, tail 1⅝.

Hab. San Antonio, in the Peruvian Andes.

Remark. The female of this species was, I believe, brought home by M. Warszewicz; but we are indebted to Mr. Henry Whitely for the discovery of the male. Its nearest ally is the *Adelomyia inornata*; but it has a longer bill than that bird, and, moreover, has the throat punctated with green instead of being of a bright blue. Mr. Whitely's specimen was collected at San Antonio in July 1871, at an elevation of 3600 feet.

Adelomyia cervina.

Crown and all the upper surface bronzy green; over and behind the eye and curving down the sides of the neck a conspicuous mark of buffy white; ear-coverts blackish brown; throat, sides of the neck, and centre of the abdomen delicate fawn-colour, with very minute speckles of brown on the former; flanks bronzy russet, with reflections of golden yellow-brown; under tail-coverts hoary buff; wings purplish brown; tail very dark olive, glossed with green; all the feathers tipped with buff, but less so on the two centre ones; bill black on the upper mandible, the lower one lighter and inclined to flesh-colour at the base.

Total length 4 inches; bill $\frac{5}{8}$, wing $2\frac{3}{8}$, tail $1\frac{3}{4}$.

Remark. This new species was discovered near Medellin in Columbia by Mr. Salmon, whose exploration of the country westward of the Magdalena has just commenced.

LXIX.—*On the Nomenclature of the Foraminifera.* By W. K. Parker, F.R.S., F.Z.S., and Prof. T. Rupert Jones, F.R.S., F.G.S.

Part XV. *The Species figured by Ehrenberg* (continued).

[Continued from p. 271.]

Appendix II.

To enable the student to utilize the foregoing collocations of the species and notable varieties of Foraminifera figured and described by Dr. Ehrenberg and other rhizopodists, it is necessary to append a classified list of the adopted names, with references to the localities and materials treated of in the 'Mikrogeologie' and the Berlin Academy 'Transactions.'

In the following List, therefore, we have arranged the genera treated of in their order, and have appended to the species numbers corresponding with those divisions of the foregoing memoir which contain references to or descriptions of them. Thus:—I. From Ægina (1), Greece. II. From Zante. III. From Ægina (2). IV. From Oran, Africa. V. From Caltanisetta, Sicily. VI. From Gyzeh and Mokattam, Egypt. VII. From Thebes, Egypt. VIII. From Antilibanon, A. IX. From Antilibanon, B. X. From Haman Feraun, Arabia. XI. From Cattolica, Sicily. XII. From Meudon, France. XIII. From Gravesend, England. XIV. From the Island of Möen, Denmark. XV. From the Island of Rügen, Baltic. XVI. From Volsk, Russia. XVII. From the Upper Missouri, North America. XVIII. From the Upper Mississippi, North America.

Nos. 19–28 (included in Section XX.) are miscellaneous fossil Foraminifera figured by Ehrenberg; thus:—19, from the Chalk of Alabama; 20, the Pläner-Kalk of Teplitz, Bohemia; 21, Nummulitic Limestone of France; 22, Nummulitic Limestone of Traunstein, Bavaria; 23, Orbitoidal Limestone of Java; 24, *Zeuglodon*-beds, Alabama; 25, *Polycystina*-beds, Barbadoes; 26, Jurassic Limestone, Baden; 27, Coral-rag, Cracow; 28, Carboniferous Limestone, Russia.

By the use of this List the student will see at a glance which are the more abundant and persistent of the species under notice; and he will also be enabled to find the synonyms, sometimes numerous, which several of them have received in the 'Mikrogeologie,' 'Abhandlungen,' and 'Berichte,' during the long course of Dr. Ehrenberg's researches.

Classified List of the Foraminifera figured by Dr. Ehrenberg.

I. IMPERFORATA.

		References to Sections (I. to XVIII.) in the foregoing Memoir, and to subsections in Section XI. (19–28).
1. **Miliola**	**sp. indet.**	**III.**
(Spiroloculina)	**sp. indet.**	**VII.**
(——)	**planulata (*Lam.*)**	**I.**
(——)	**(stoloniferous)**	**23.**
(Quinqueloculina)	**sp. indet.**	**VII., XI., 22?**
(Triloculina)	**sp. indet.**	**23.**
2. **Alveolina**	**sp. indet.**	**22?, 23.**

II. ARENACEA.

3. **Lituola (Haplophragmium)**	**sp. indet.**	**22, 24.**
4. **Endothyra**	**sphæroidea (*Ehr.*)**	**26.**
	antiqua (*Ehr.*)	**28.**
5. **Valvulina (Tetrataxis)**	**palæotrochus (*Ehr.*)**	**28.**

III. PERFORATA.

6. **Lagena**	**globosa (*Montagu*)**	**VI., VII., XII., XIV.**
	—— (entosolenian)	**20.**
	sulcata (*W. & J.*)	**XI.**
	costata, *Williamson*	**VII., XVIII.**
	clavata, *D'Orb.*	**XVIII.**
	stiligera (*Ehr.*)	**XVI.**
	apiculata, *Rss.*	**XIV.**
	elongata (*Ehr.*)	**VIII., XI.**
	emaciata, *Rss.*	**VII., XVI., XVIII.**
7. **Glandulina**	**lævigata, *D'Orb.***	**XI., XVIII.**

		References.
8. **Nodosaria**	filiformis, *D'Orb.*	I., III., VIII.
	glabra, *D'Orb.*	XVII., XVIII.
	acus, *Ehr.*	XVII.
	ovicula, *D'Orb.*	VII., VIII., IX., XII., XIII., XIV., XV., XVI., XVIII.
	pyrula, *D'Orb.*	VII., 21.
	gracilis, *D'Orb.*	XI.
	subulata, *Rss.*	XIV.
	subnodosa, *Rss.*	VIII.
	hispida, *D'Orb.*	XIV.
	? index, *Ehr.*	28.
	sp. indet	24, 27.
9. **Dentalina**	Boueana, *D'Orb.*	XVIII.
10. **Vaginulina**	lævigata, *Rœm.*	VII., XI., XIII.
	leguminiformis (*Batsch*)	VII., XVIII.
	longa, *Cornuel*	XIII.
	acuta, *Ehr.*	XIV.
	subulata, *Ehr.*	21.
	marginata, *D'Orb.*	XVI.
	sp. indet	24.
11. **Marginulina**	ensis, *Rss.*	XIV.
12. **Planularia**	tenella, *Ehr.*	XIV.
	crepidula (*F. & M.*)	XVIII.
13. **Cristellaria**	italica (*Defr.*)	VII.
	rotulata (*Lam.*)	III., XI., XV., XVIII.
	cultrata (*Montf.*)	III., VI., VIII., XI., XII., XIII., XV., XVIII.
	sp. indet	XVII ?, 27.
14. **Polymorphina**	lactea (*W. & J.*)	XVI.
	compressa, *D'Orb.*	VII., VIII., XVIII.
	problema, *D'Orb.*	XI.
	tuberculata, *D'Orb.*	XIV.
	Thouini, *D'Orb.*	XI., XII., XIII.
	sp. indet	20 ?, 24 ?
15. **Bulimina**	aculeata, *D'Orb.*	I.
16. **Bolivina**	punctata, *D'Orb.*	I., III., IV., VI., VII., VIII., XI., XII., XIV., XV.
	dilatata, *Rss.*	III., IV., VI., VII., XIV., XV., XVI., XVIII.
	americana (*Ehr.*)	XVIII.
	argus (*Ehr.*)	III.
	Reussii (*Gein.*)	XV.
	incrassata, *Rss.*	XV.
	sulcata (*Ehr.*)	III.
	costulata (*Ehr.*)	VIII.
	aculeata (*Ehr.*)	XIV.
17. **Virgulina**	squamosa, *D'Orb.*	VII., XII., XIV., XV., XVI., XVIII.
	—— tegulata, *Rss.*	XII.
	—— asparagus (*Ehr.*)	XII., XIV.
	—— Schreibersii, *Czjz.*	I. ?, III., V., VII., XI., XII., XIII., XV., XVI., XVII., XVIII.
	Hemprichii (*Ehr.*)	IV., VI., VII., VIII. ?, XI., XIII. ?, XIV., XV., XVI. ?, XVIII.
	—— gemma (*Ehr.*)	III., XIV.
	—— nucleus (*Ehr.*)	XV.
	—— calcipara (*Ehr.*)	XV.
	—— tessera (*Ehr.*)	XVIII.

		References.
Virgulina	**Hemprichii americana** (*Ehr.*)	XVIII.
	—— **stiligera** (*Ehr.*)	XI.
	—— **paradoxa** (*Ehr.*)	XI.
18. **Bifarina**	**saxipara** (*Ehr.*)	XVIII.
19. **Textilaria**	**globulosa**, *Ehr.*	VI., VII., VIII., X., XII., XIII., XIV., XV., XVI., XVIII., 19, 20, 22.
	gibbosa, *D'Orb.*	I., IV., VI., VII., VIII., X., XI., XII., XIII., XIV., XV., XVI., XVII., XVIII.
	agglutinans, *D'Orb.*	VI., VII., VIII., XII., XIII., XVI., XVIII., 19, 24.
	sagittula, *Defr.*	VI., VIII., IX., XI., XII., XV., XVI., 21, 24.
	pinnula, *Ehr.*	XIV.
	subangulata, *D'Orb.*	XIII., XIV., XV., XVI.
	striata, *Ehr.*	XIII., XIV., XV., XVII., XVIII., 19.
	striato-punctata, *Egger*	XVII.
	missouriensis, *Ehr.*	XVII.
	americana, *Ehr.*	XVII., 19.
	trilobata, *Ehr.*	23.
	bursigera, *Ehr.*	28.
	falcata, *Ehr.*	28.
	lunata, *Ehr.*	28.
	sp. indet.	V.?
20. **Spiroplecta**	**rosula**, *Ehr.*	XVIII.
	americana, *Ehr.*	XVII., XVIII., 19.
	sp. indet.	24.
21. **Vulvulina**	**pennatula** (*Batsch*)	XIII.
	apiculata (*Ehr.*)	XI.
22. **Bigenerina**	**digitata**, *D'Orb.*	XVIII.
	acanthopora (*Ehr.*)	XVI.
	javanica (*Ehr.*)	23.
23. **Heterostomella**	**tumens** (*Ehr.*)	XVI., XVIII.
	aculeata (*Ehr.*)	XII., XIII., XV., XVI.
24. **Verneuilina**	**pygmæa** (*Egger*)	XII., XIV., XVIII., 19, 22.
	spinulosa, *Rss.*	XIII.
25. **Orbulina**	**universa**, *D'Orb.*	XV., XVI.
26. **Globigerina**	**cretacea**, *D'Orb.*	VII., VIII., XII., XIII., XIV., XV., XVI., XVIII., 19.
	bulloides, *D'Orb.*	I., III., IV., V., VI., VII., XI., 24.
	hirsuta, *D'Orb.*	XVII.
	sp. indet.	20, 22?
27. **Sphæroidina**	**bulloides**, *D'Orb.*	XII.
28. **Planorbulina**	**Haidingerii** (*D'Orb.*)	I., III., V., VII., VIII., XI., XV., XVI.
	denticulata (*Ehr.*)	III.
	ammonoides (*Rss.*)	IV., V.?, VI., VII., IX., XI., XII., XIII., XIV., XV., XVIII., 25.
	globulosa (*Ehr.*)	I., II., III., VI., VIII., X., XI., XII., XIV., XV., XVII.
	farcta (*F. & M.*)	VI., VII., VIII., XI.
	vulgaris, *D'Orb.*	VII., VIII., IX., 24.
	sp. indet.	19, 25.
29. **Planulina**	**ariminensis**, *D'Orb.*	I.?, III.?, VI., VII., VIII., IX., XIV., XVI., XVIII.
	sp. indet.	II.?

			References.
30. Pulvinulina	*repanda* type	spatiosa (*Ehr.*)	IV., XIV.
		squama (*Ehr.*)	XV.
	Menardii type	Menardii (*D'Orb.*)	XI.
		Pharaonum (*Ehr.*)	VI.
		truncatulinoides (*D'Orb.*)	XII.
		Micheliniana (*D'Orb.*)	XII., XIII., XV.
	Schreibersii type	Karsteni (*Rss.*)	VIII.
	elegans type	elegans (*D'Orb.*)	XIV. ?
		Orbignyi (*Ræm.*)	XIV. ?
		caracolla (*Ræm.*)	XVI.
31. Synspira		triquetra, *Ehr.*	XIV.
32. Rotalia		Beccarii (*Linn.*)	24.
		ammoniformis (*Lam.*)	VI.
		orbicularis, *D'Orb.*	III.
33. Nonionina		scapha (*F. & M.*)	VI.
		sp. indet.	II. ?
34. Polystomella		craticulata (*F. & M.*)	23.
		sp. indet.	22, 24.
35. Orbitoides		javanicus, *Ehr.*	23.
		Mantelli ? (*Morton*)	23.
36. Operculina		complanata (*Defr.*)	VI.
		ammonis (*Ehr.*)	22.
		turgida (*Ehr.*)	XVI.
		sp. indet.	21 ?, 23.
37. Nummulina		gyzehensis (*Forsk.*)	VI.
		curvispira, *Meneg.*	VI.
		Guettardi, *D'A. & H.*	VI.
		Murchisoni	22.
		Dufrenoyi	22.
		striata, *D'Orb.*	21.
		planulata (*Lam.*)	21.
38. Amphistegina		javanica, *Ehr.*	23.
		sp. indet.	22.
39. Fusulina		cylindrica, *Fischer*	28.
		constricta (*Ehr.*)	28.
		palæosphæra (*Ehr.*)	28.
		sphæroidea (*Ehr.*)	28.
		labyrinthiformis (*Ehr.*)	28.
		palæophacus (*Ehr.*)	28.
		palæophus (*Ehr.*)	28.

BIBLIOGRAPHICAL NOTICES.

New Ornithological Works.

The first in importance of the works we here propose to notice is Andersson's 'Birds of Damara Land,' edited by Mr. J. H Gurney*.

For nearly seventeen years Mr. Andersson collected materials for a work on the bird-fauna of South-western Africa, when death prevented him from accomplishing his task, the arrangement of which had already been commenced. Most fortunately for ornithological science he left behind him copious notes, which, with numerous prepared skins, made it possible for another to take up the work where he left it off and carry it to a successful conclusion. Yet Mr. Gurney's task in editing and arranging Andersson's notes has been no light one; and no small amount of original work has he performed in determining the species, and in making intricate points of synonymy intelligible to the student of ornithology.

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* 'Notes on the Birds of Damara Land and the adjacent countries of South-west Africa.' By the late Charles John Andersson, author of 'Lake Ngami' and of 'The Okavango River.' Arranged and edited by John Henry Gurney, with some additional notes by the Editor, and an introductory chapter containing a sketch of the Author's life, abridged from the original published in Sweden. London: 1872. 8vo, pp. 394, with a map and 3 plates. (Van Voorst.)

Andersson's own notes describe the habits of each species, and give the places where they were found. For descriptions the reader is referred to Layard's 'Birds of South Africa,' and in many cases to Finsch and Hartlaub's 'Vögel Ost-Afrika's.'

In the nomenclature adopted by Mr. Gurney he has, we think, pushed the use of generic subdivisions to an extent that future researches will not warrant. He makes use of most of the terms given in Gray's 'Hand-list' in a subgeneric sense as indicating genera. It will be some time yet before ornithologists come to any agreement on the moot point of the value of generic names; for very much hasty work has to be carefully examined before many a genus can fairly be accepted or rejected as such. Yet we hardly think that the genera proposed, frequently in the most off-hand informal manner, by Bonaparte, or in such works as those of Reichenbach, are entitled to the respect here accorded them.

As a contribution to the knowledge of the geographical distribution of birds this work is invaluable, and makes a sensible addition to our information on African birds, now fast becoming complete, from Cape Colony northwards to the limits of Andersson's researches. With Cape Colony itself, Mr. E. L. Layard's useful little volume has made us familiar; while on the east coast in Port Natal and the Trans-Vaal Republic another diligent explorer, Mr. Ayres, with whom Mr. Gurney has cooperated, has done excellent work. Northward of these points our knowledge is but fragmentary; while of the ornithology of the districts the scenes of Livingstone's recent journeyings we, of course, know nothing as yet. In conclusion, we must record our opinion that this volume is a real and substantial addition to ornithological literature, and that we owe much to Mr. Gurney for rescuing Andersson's valuable notes from the danger in which his death had placed them.

The ornithology of Egypt has long been a subject of interest, and its birds have most of them been mentioned in various articles of greater or less completeness scattered though the pages of 'The Ibis' and elsewhere; so that, though Captain Shelley has done good work in collecting these scattered materials*, more especially as he has verified and observed for himself during several visits to the country, not much novelty was to be expected in retraversing well-trodden ground.

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* 'A Handbook to the Birds of Egypt.' By G. E. Shelley, F.G.S., F.Z.S., &c. London: 1872. Large 8vo, pp. 342, with 14 coloured plates. (Van Voorst.)

Some short chapters at the commencement of the book give a general idea of the mode of travelling in Egypt, and of the favourite haunts of its birds. These serve as an introduction to the more formal part, where each species of bird is individually treated of and described.

The number of species mentioned is 352, which at first sight seems a large total when the nature of the country is taken into consideration, and seeing that no high mountain-chains are present to maintain a varied fauna. But Egypt is peculiarly situated, being the only strip of fertile land, with deserts on either side, to form a connexion between the Mediterranean and the equatorial regions of Africa, and is hence a highway, as it were, for birds passing both north and south. The number of birds, both of species and individuals, is doubtless increased by this favourable circumstance.

The portion of Egypt treated of by Captain Shelley is confined between the Mediterranean and the Second Cataract, and west and east by the Libyan and Arabian deserts. A glance at the list of birds found there shows that they chiefly belong to the fauna of South-eastern Europe. Its connexion with Ethiopia proper and with the East is only shown here and there by the presence of such forms as *Pycnonotus*, *Crateropus*, *Nectarinia*, and *Centropus*. But Egypt, though belonging to the European fauna, forms quite an outlying province of it; passing a little further south, we come to the truly Ethiopian fauna of Abyssinia.

But to return to the book itself. Captain Shelley's plan throughout has been to give the Latin and English name of each species, a short note of the places where it is found in Egypt, a brief description and a reference to some well-known illustrated work to assist in the subsequent identification of each species. Where his own observations have been extended or modified by others who have preceded him over the same ground, he has given a reference to the observation quoted. These chiefly refer to the works of Von Heuglin, who has travelled in and written much on the ornithology of this country and those adjoining it immediately to the southward.

With this plan we have not much fault to find; and we believe that any one travelling in Egypt with Captain Shelley's book, and a smattering only of bird lore, will make fair way in determining the birds he shoots; but his task would have been instructively lightened had a little assistance been rendered him towards determining the genera and higher groups, which, as the work stands, are left for determination to any prior knowledge the traveller may possess. But we are, in the case of genera, perhaps asking a little too much in a work of this description; we regret, however, to see serious confusion in the names of the families, and even orders, which we are at a loss to account for, unless it be that pardonable oversights in the MS. have not been detected by a careful revision of the proofs.

The plates in this work are very acceptable, and have been executed by Mr. Keulemans in the style which has rendered him so favourite an ornithological draughtsman. The subjects are judiciously selected from characteristic or peculiar species.

Mr. Harting's last contribution* brings us nearer home; and though he offers a quasi apology for adding another to the already extant works on British Birds, we think none was needed; and we doubt not the present volume will be accepted as a useful addition to the ornithological literature of the British Islands.

In the first portion Mr. Harting comes forward as a reformer of nomenclature, and, to some extent, of arrangement, taking Yarrell's third edition as his starting-point. On both subjects he still leaves room for justifiable improvement. As regards nomenclature, the three rules he specifies as his guide by no means attempt to solve several intricate questions—such, for instance, as the best generic name available for the Nightingale. He uses *Luscinia*; but we think *Daulias* of Boie, on the whole, far preferable. Then, too, why should Linnæus's name in connexion with the Stilt entirely disappear? There are other cases we might mention. Mr. Harting states that he has avoided the use of subgeneric names; yet he does not hesitate to place the Titlarks under a family name, *Anthidæ*, as distinct from the Wagtails, *Motacillidæ*, and to banish the Rock from the true Thrushes under the name *Petrocinclidæ*. We are at a loss to know, and Mr. Harting makes no attempt to show us, how the adoption of these family names can be justified by the production of definite characters of sufficient value to show their distinctness.

The alterations in arrangement are so far advantageous; but a little more might have been done in this direction without doing much violence to the feelings of British ornithologists. We point especially to the retention of the *Hirundinidæ* in juxtaposition with the Swifts. Those whose studies are bestowed on exotic species are considerably in advance of their fellow students whose attention is confined to the birds of these islands in such matters; and with them there are questions of affinities which have passed out of the region of doubt which are clung to by our home naturalists with, we might say, almost obstinate tenacity. What is required of our workers at home is a more independent spirit, a thorough investigation of bird-structure, and, what has never been the case, a keener appreciation of the work that is going on around them, much of which affects the special sphere to which they may confine their attention.

The second portion of Mr. Harting's work has the merit of greater completeness; and in gathering together all the records of the appearance of occasional visitants to our shores, he has provided workers over the same ground with a ready index to facilitate their labours. The records thus gathered show a goodly list of instances where members of the same species have over and over again wandered to our shores; and on seeing how numerous in some cases they are, one cannot refrain from the feeling that it is far from impossible that we might now own some of these birds as established settlers had the treatment they received at our hands been reversed. The passion for collecting British-killed birds, so prevalent at the present time, has much to answer for.

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* 'A Handbook of British Birds, showing the Distribution of the Resident and Migratory Species in the British Islands, with an Index to the records of the Rarer Visitants.' By J. E. Harting, F.L.S., F.Z.S., Member of the British Ornithologists' Union, &c. &c. London: 1872. Large 8vo, pp. 198. (Van Voorst.)

In his introductory chapter, Mr. Harting has analyzed the occasional visitants to show the origin whence they came. It is not a little surprising to see how large is the proportion of American species which again and again find their way to these shores. He finds it extremely difficult to believe that the non-aquatic species have actually performed unaided this journey of, at least, 1700 miles; but of the powers of sustained flight possessed by birds we, as yet, know very little indeed, and the task may not, under favourable circumstances, be so difficult as it would appear.

In reading Mr. Harting's book we detect some errors perhaps unavoidable in a work of the kind; but there are others we hardly expected to see, such as the mistake about the Grouse and Ptarmigan in the Introduction (p. xvii). We are not aware that the distinctness of the Ptarmigan of Scotland from the continental bird has ever been advocated; whilst the validity of the Grouse of the British Islands to be considered a species distinct from the Willow Grouse has been a bone of contention for years. Then, too, Gilbert White's account of the Honey Buzzard breeding in Selborne Hanger is overlooked, and also the fact of the Harlequin Duck breeding regularly in considerable numbers in Iceland. Mr. Harting records it as of accidental occurrence in Europe.

But we are not disposed to criticise too severely a book which will prove of undoubted service.

MISCELLANEOUS.

The Bell Collection of Reptiles.

To the Editors of the Annals and Magazine of Natural History.

Museum of Zoology and Comparative Anatomy,
Cambridge, Nov. 22, 1872.

GENTLEMEN,—My attention has been drawn to the letters of Prof. Westwood and Dr. Gray in the 'Annals and Magazine of Natural History' for November 1872, respecting Mr. Bell's collection of reptiles. I beg to be allowed to make the following statement.

The whole of that gentleman's museum was purchased by my late father, Professor Clark, in 1856, who thus describes the acquisition in the preface to the 'Catalogue of the Osteological Portion of Specimens contained in the Anatomical Museum of the University of Cambridge' (Cambridge, 1862):—

"In 1856 I had the pleasure of increasing the Collection by adding to it the osteological collection of Professor Bell, F.R.S., &c.

&c., by which every order of Vertebrata is more adequately represented, and especially that of the Reptiles, amongst which is that valuable collection he had formed for the illustration of his work on the 'Testudinata.' His specimens are marked 'Bell collection.'"

It is of course quite possible that some specimens might have passed into the hands of dealers before Mr. Bell sold the collection; but these could not have formed an important portion of the whole, as Mr. Bell expressly stated to my father that he was selling to him his entire museum. This fact is impressed upon my memory by the recollection of my father's annoyance and regret at the non-appearance of one specimen, a skull of the Sumatran rhinoceros, which was noted in Mr. Bell's MS. catalogue (which I now possess) as part of his collection, and which could never be found. It would be interesting, especially at the present time, to know what has become of this skull.

We have at present at least thirty-three skeletons and parts of skeletons of *Chelonia* alone, which belonged to Mr. Bell—a number even larger than that noted in his Catalogue. I think this fact proves conclusively that whatever Mr. Hope may have purchased and given to the Oxford Museum, it could not have been the "Bell Collection of Reptiles" properly so called. I ought to mention that we received no specimens in spirit from Mr. Bell, nor any in a stuffed state.

There is but one trifling error in Dr. Gray's letter of October 24. He says that he consulted Mr. Bell's specimens "in the Museum of the Cambridge Philosophical Society, where they were before they were transferred to the Anatomical Museum." The collection was never placed, even for a single day, in any other building than the Museum of Anatomy.

I am, Gentlemen,
Your obedient servant,
J. W. Clark (Superintendent).

To the Editors of the Annals and Magazine of Natural History.

November 22, 1872.

Gentlemen,—My attention having been directed to a correspondence in the 'Annals' between Dr. Gray and Professor Westwood, I find myself called upon to state that Dr. Gray is entirely in error respecting the distribution of my collection of Reptilia, including, in particular, the Testudinata.

In the year 1856 I sent a few specimens of the latter, with others of my osteological collection, to my late friend Professor Clark, of Cambridge. Amongst them there are now in the museum at Cambridge, as I am informed by my friend Professor Newton, *the shells* of only about half a dozen species of Testudinata, besides a few heads and several osteological specimens. In 1861, five years subsequently to my sending these few specimens to Cambridge, the whole of my large collection of Reptilia was purchased by Mr. Hope, in order to present it entire to the new museum at Oxford, where it now is. Amongst the specimens included are those which formed the subjects figured in my work on the Testudinata. I have to add that the few duplicates (for such they were) of the shells of tortoises at Cambridge are, most of them, of common occurrence in collections.

THOMAS BELL.

On Spatulemys Lasalæ, *a new Genus of* Hydraspidæ *from Rio Parana, Corrientes.* By Dr. J. E. GRAY, F.R.S. &c.

Colonel P. Perez de Lasala has kindly presented to the Museum a water-tortoise from Rio Parana, Corrientes, which has not been recorded in scientific catalogues. It differs from *Hydraspis* in the general form of the head and thorax, and in the head being entirely covered with small shields. It is like *Hydromedusa* in many particulars, especially in the thorax of one sex at least being concave; but it has a regular small nuchal plate.

SPATULEMYS.

Thorax oblong, elongate, depressed, with a distinct elongate nuchal plate. First vertebral plate very broad; second, third, and fourth longer than broad; anterior marginal plates broad; the second and ninth largest, angular above. The sternum elongate, broad and rounded in front, deeply notched behind; gular plate large, marginal. Head broad, depressed, entirely covered with small polygonal shields; forehead convex, rhombic, with a broad flat crown between the very large temporal muscles; chin with two beards; mouth broad and rounded in front. The two outer hinder claws very small, rudimentary. Tail conical. Sternum in male (?) slightly concave, especially behind.

Spatulemys Lasalæ.

Shell above olive, nearly uniform, with a few small black spots on the margin, which are more abundant and larger on the hinder plates. Thorax and underside of margin pale, with symmetrical black spots, which are largest on the front and sides of thorax. Length of thorax 15 in., breadth 8½ in.; length of head 2½ in.

Hab. Rio Parana, Corrientes (Colonel P. Perez de Lasala, November 5, 1872).

Observations on the Metamorphoses of the Bony Fishes in general, and especially on those of a small Chinese Fish, of the Genus Macropoda, *recently introduced into France.* By M. N. JOLY.

In a letter addressed to M. H. Milne-Edwards on the 24th of December 1864, M. Agassiz expressed himself as follows:—"I have lately observed among fishes metamorphoses as considerable as those which are known among reptiles. Now-a-days, when pisciculture is pursued with such success and on so large a scale, it is surprising that this fact has not long since been observed"*.

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* See Ann. des Sci. Nat. 5^{e} sér. tom. iii. p. 55.

By the kindness of M. Guy, who is successfully rearing a pair of *Macropodæ* in his magnificent aquarium of the Faubourg Saint-Cyprien, I have been able to study, not only the nidification of this handsome fish, but also its ova and their development, which is so rapid that I have seen them hatched in sixty hours. I shall not enter into long details as to the embryogeny of our *Macropodæ*, as I have the intention of soon making known all its phases, with numerous drawings to illustrate them. It will be sufficient at present to say that the development of our little Chinese fishes presents much analogy with that of the perch, which was so well studied by our colleague Lereboullet. I shall therefore at present confine myself to the most striking features.

The ovum of the *Macropoda*, which is of the size of a poppy-seed at the time of its being deposited, is distinguished by its perfect transparency and its density, which is inferior to that of water. Hence it rises of itself to the surface and comes into contact with the air-bubbles which compose the nest fabricated by the male, or which are expelled from his mouth when he respires. We have already stated that the embryogenic work which has to be accomplished within the ovum does not last longer than from sixty to sixty-five hours; but rapid as the hatching is, it is not more so than that of the tench and some other fishes. But it will be easily understood that, in consequence of this rapid developmemt, the animal must be born in a very imperfect state. In point of fact it presents the form of an obese tadpole, the head and trunk of which are applied to an enormous umbilical vesicle, whilst the tail is free, already very mobile, and furnished all round with an extremely transparent natatory membrane.

Although it appears to be completely destitute of striated muscular fibres, the animal wriggles briskly upon the object-slide. It is about 1½ millim. in length.

Its head is remarkable by the existence of two large eyes still destitute of pigment. The mouth does not yet exist. This is also the case with the intestine and the anus. But the heart has already been in motion for more than twelve hours, and there is an active circulation in a part of the tail (nearly the anterior half), in the vitelline vesicle, and in the remainder of the body. There are no branchiæ; the respiration is effected by means of the skin and the umbilical vesicle; there are no secretory organs of bile or urine, no genital organs, and no fins properly so called.

As in all fishes and, indeed, in all Vertebrata, the nervous system, which is very early formed, consists of two parallel cords which swell out in the head to give origin to the cerebral vesicles. The skeleton is as yet represented only by the *chorda dorsalis*; the vertebral laminæ, if they exist, are not yet very distinct.

Numerous pigment-spots are to be seen upon all parts of the body, and even upon the umbilical vesicle.

Many organs which do not yet exist will appear sooner or later after birth. Of this number are the mouth, the intestine, the liver, the swimming-bladder (at least in the perch); the genito-urinary organs, the hyoid apparatus, and especially the branchiæ will be formed. The circulation which took place in the umbilical vesicle, a provisional respiratory organ, will cease. New vessels will appear and others will become atrophied; the *chorda dorsalis* and the sheath which surrounds it will become solidified to produce the bodies of the vertebræ. The true or permanent fins, at first reduced to two pectoral palettes which the animal agitates very rapidly, will originate in the interior and at the expense of the embryonic caudal membrane or fin; finally brilliant iridescent scales will cover the body of the animal, which, from this moment, will appear under the form belonging to the adult age.

Such is, briefly, the series of changes which will be manifested at various intervals in our new-born fish. These changes are exactly of the same nature and at least as considerable and numerous as those which occur in *Petromyzon Planeri*, in the Insects, or in the Crustacea (*Caridina Desmarestii*, *Cancer pagurus*, &c.). Formation of new parts (mouth, intestine, branchial apparatus, genito-urinary apparatus, permanent fins, vertebral arches), disappearance of parts previously existing (vitelline vesicle and its vessels, embryonic caudal membrane), modifications in the form of the body, in that of the heart and in its structure (which was at first entirely cellular), in the eyes (originally destitute of pigment and becoming movable instead of immovable as at first), &c. &c. Now *formation*, *disappearance*, and *modification* are the three essential modes which are included, according to Dugès, in that very complex operation that we call *metamorphosis*; and if I am not deceived, the embryogeny of the *Macropoda* has displayed them to us.

To accept the reality of metamorphosis in the case of the grasshopper for example, and the other Orthoptera or Hemiptera which *quit the egg with all their parts except the wings*, and to refuse to believe in this phenomenon when we have to do with osseous fishes such as the perch or the *Macropoda*, would, it seems to me, be to show a deficiency of logic and to close our eyes voluntarily against evidence.—*Comptes Rendus*, Sept. 30, 1872, p. 766.

On the Habits of Terebratulæ, *or Lamp-shells.*

By Dr. J. E. Gray, F.R.S. &c.

Mr. Davidson informs me that the shell I have named *Terebratula truncata* in the 'Annals and Magazine of Natural History' for 1872 (x. p. 152) is what is now called *Kraussia rubra* (*T. rubra*, Pallas). He also informs me that "Mr. Jeffreys found a number of specimens of *Terebratulina caput-serpentis* attached to seaweed; and he believes some forms of *Argiope* that occur in the Mediterranean likewise affix themselves to seaweed."

On referring to Mr. Jeffreys's 'British Conchology,' ii. p. 15, he says, "*T. caput-serpentis* is attached to stones, old shells, and occasionally to small seaweeds and other substances;" and Mr. Davidson informs me that "Prof. E. Forbes had found some small specimens of *Argiope* attached to Fuci, though more commonly attached to stones."

It therefore appears that the habitat I gave for *Kraussia rubra* is not quite peculiar to that species, though it certainly is the usual habitat of *Kraussia*, while in other lamp-shells attachment to seaweeds is the exception.

On the Connexion which exists between the Nervous System and the Muscular System in the Helices. By M. Sicard.

In his celebrated memoir on the slug and the snail, Cuvier has described the *submission* (to use the term which he has employed) of the nervous to the muscular system. It is established, in his opinion, by the *close cellulosity* which unites the retractor muscles of the great tentacles to the envelope of the cerebroid ganglia, and the principal lobes of the retractor muscles of the foot to that of the subœsophageal ganglia. Since then, every one abides by that assertion; nevertheless the union of the two systems is much more intimate than was indicated by Cuvier, and histological study shows that they are directly united with each other. It is not, in fact, simply cellular tissue which joins the nervous centres to the neighbouring muscles; microscopical examination discloses, in this tissue, the presence of smooth muscular fibres; so that the nervous system is surrounded by an actual expansion of the muscular apparatus.

In certain species the arrangement is very manifest, particularly in *Zonites algirus*—that old *Helix* of which a great many malacologists justly make a distinct genus. In it clearly marked membranous muscles surround the œsophageal collar. From the upper surface of the retractor muscle of the foot, from the outside, and for nearly half its length, there starts on each side a little muscular band two millimetres in width, which soon divides into two lobes, the outer of which, the external, goes to the superior, and the other to the small tentacle; these muscles are known as the retractor muscles of the tentacles. Now the little band which constitutes the second of these muscles enlarges, spreads like a fan on the internal side to unite with the neurilemma of the œsophageal collar, and thus form with its fellow a sort of muscular framing; then this muscle goes to the little tentacle with the nerve which is destined for it. On the other hand the muscular bundle which goes to the superior tentacle receives into its interior the tentacular nerve, which, from its point of origin on the subœsophageal ganglion to the point where it enters into the cavity of the retractor muscle, is accompanied by a *muscular* band, which envelops it and which thus unites the nervous centres to this muscle.

The connexion just described, of the retractor muscles of the tentacles with the œsophageal collar, and the union of these two muscles behind into a single primitive bundle, would make it more proper to designate this muscular whole the common retractor muscle of the tentacles and nervous collar. The action, however, is not so simple as this denomination would seem to indicate; for if during the retreat of the animal all these parts act in order to produce the retraction, they do not act all in the same way during its unfolding. Then the portions placed in front of the nervous collar intervene, at least passively, in its protraction. These muscular bands having on one side their points of attachment to the integuments, they must, as the latter are carried forward, aid in drawing the collar into this movement if they did not act only as simple ligaments.

This is not all; the muscular expansion which surrounds the nervous collar furnishes to the nerves which start from the supra- and subœsophageal ganglia a regular contractile sheath. This is often considerable, and then, if the nerve be examined by the microscope, under a low power, or by the help of a simple lens, it presents the appearance of an opaque, more or less flexuous cord in the middle of this envelope, which constitutes an *external neurilemma* for it, the histological composition of which must detain us a moment. In the first place we find in it a superficial conjunctive layer, formed by voluminous cells, the mean diameter of which is ·05 millimetre, and which is, up to a certain point, comparable to the *adventitia* of the vessels. Below this cellular membrane we recognize the presence of a muscular layer formed of fine and very elongated fibres arranged longitudinally. It is easy to ascertain the existence of these muscular elements by macerating, for three or four days, the collar and the nerve which starts from it in a mixture of equal parts of hydrochloric and nitric acids, diluted with ten or twelve parts of water. It is then easy to separate them.

Immediately round the nerves may be remarked a second conjunctive element, or inner neurilemma, composed of cellular elements, but less voluminous. These cells are about 0·025 millimetre in diameter.

This double neurilemmatic envelope has not yet been indicated, so far as we know, in the animals under consideration. Leydig has observed it in the Arthropoda and in the Annelida, where the external neurilemma is represented by the ventral vessel; he has recognized, particularly in the earthworm, the presence of muscular elements; but we have nowhere seen the existence of these elements indicated in the neurilemma of the Mollusca. According to Leydig, it takes that cellular form of conjunctive tissue which is seen elsewhere among the organs. This is only correct with regard to the superficial cellular layer; and what we have said shows how much more complex is the composition of this neurilemma.

The existence of muscular fibres in the sheath which encloses the nerve has the effect of producing an elongation and shortening of this *musculo-nervous* cord; and, indeed, when there is a contraction, the flexuosities described by the nerve in its envelope are more marked the stronger this contraction is; in the state of relaxation, on the contrary, the nerve follows a rectilineal direction.

It is plain that this peculiar musculature of the nerves has a manifest physiological relation with the intimate connexion that we have indicated between the nervous collar and the muscular apparatus. In consequence of this connexion, in fact, the nervous centres connected with the muscles suffer some displacements in relation to the changes of form that the body undergoes when the animal retracts or expands itself; and the nerves themselves, by virtue of the muscular envelope with which they are provided, being able to elongate or shorten themselves, form active bands, which intervene in the modifications which the movements of the animal cause. — *Comptes Rendus*, September 30, 1872, pp. 769-771.

On Delphinus Desmarestii, *Risso* (*Aliama Desmarestii*, Gray).

By Dr. J. E. Gray, F.R.S.

Risso, in his 'Histoire Naturelle de l'Europe Méridionale,' describes and figures a species of dolphin under the name of *Delphinus Desmarestii* (vol. iii. p. 24, t. 2. f. 3). As the figures of the two dolphins on the preceding plate are accurate, and his figures in general reliable, and the figure itself agrees with the description, I am inclined to regard it as correct until it is proved otherwise. It has been considered the same as *Ziphius cavirostris* of Cuvier, a ziphioid whale. It is so unlike all the other ziphioid whales known that it may be considered one of the whales requiring further examination. Instead of having the rounded head and short cylindrical beak and small pectoral and dorsal fin common to all the ziphioid whales, it has an elongated, conical, tapering head, acute in front, with two teeth produced in front of the lower jaw, elongate-lanceolate pectoral fins low down on the sides of the body, like the *Grampus* and *Globiocephalus*, and a large elongated truncated dorsal fin; and the body is marked with a multitude of irregularly placed white lines, as in *Grampus*. The female described and figured was nearly 20 feet long.

In the P. Z. S. 1864, p. 242, I proposed a genus for this dolphin under the name of *Aliama*; but I unwisely placed the *Hyperoodon de Corse*, Doumet, Bull. Soc. Cuviér. 1842, p. 207, t. 1. f. 2, and *Delphinus Philippii*, Cocco, Erich. Arch. 1846, p. 204, t. 4. f. 6, which are both true ziphioid whales, probably belonging to the genus *Epiodon*, as synonyma of the same species. Most probably Doumet's *Hyperoodon de Corse* is the animal of the skull described as *Ziphius cavirostris* of Cuvier; if it is the *Ziphius de Corse* of Gervais (Ostéog. Cét.), which appears to be a female animal, it is interesting as showing that the inner side of the intermaxillaries of the female animals are dilated and turned up.

This whale has been confounded with *Delphinus Desmarestii* under the name of *Epiodon Desmarestii* (see Suppl. Cat. Seals and Whales, p. 98), figured by Gervais, which differs from all other *Petrorhynchi* in the inner margin of the intermaxillary bones not being nearly so much elevated behind as in that genus, and not elevated but rounded in front, and margining the linear vomer; while in *Petrorhynchus* the inner edge of the intermaxillaries is dilated, forming a well-marked concavity round the nostrils, and much elevated on the sides, forming a thin hood over each side of the much-swollen vomer.

I should propose to call this species *Epiodon Heraultii*, to distinguish it from Risso's *Delphinus Desmarestii.* The skull of *E. Heraultii* and *Petrorhynchus cavirostris*, as shown in Gervais's figure, is very different; and probably, as the *Hyperoodon de Corse* of Doumet is proved to be the animal of *Petrorhynchus*, *Delphinus Philippii* of Cocco may be the animal of *Epiodon Heraultii.*

The Swedish Scientific Expedition.

[Extract from a letter from Mr. J. E. Lindahl to Dr. J. E. Gray.]

My Greenland expedition was very successful. The 'Gladan' shipped the meteorite iron at Disco Island, and then she made a cruise to some places where our geologist, Dr. Nanckhoff, wanted to carry out his explorations; and Dr. Th. M. Fries, a botanist who had joined the expedition as a private passenger, followed him. I had got the steamer 'Inzegerd' for my dredging-operations. I went up to Upernivik at the 73rd degree of latitude, thence westward till we met the lasting ice; and following the edge of the ice we made southward down to St. John's, Newfoundland, to fall in with the 'Gladan' and return to Sweden in company.

From Cape Terewek to Upernivik, and thence to St. John's, we dropped our dredges at least once for every degree of latitude that we passed, often in pretty good depths of water down to 980 fathoms. In 410 fathoms I got two specimens of the *Umbellula grœnlandica*—I think better *Umbellularia encrinus.* There is not the slightest doubt that they are not of the same species as those described and figured by Ellis and Mylius. My specimens are younger, only some 12 inches long, and with fewer polypes (about 12), than in the former ones. I am just going to work out a paper upon them, which will probably appear in the beginning of next year. Although these animals are probably the most interesting things brought home by the expedition, they are by no means the only objects of high scientific value. Among the great number of siliceous sponges and starfishes, as well as some other groups of animals, I have reason to believe that many new or rare things are to be found; but nothing is yet examined except the Arachnida, described by Tamerlan Thorell in the 'Œfversigt af Kongl. Vetenskaps Akademiens Förhandlingar,' 1872, no. 2, pp. 147–166. I had not much time for explorations on shore. Our physicists, Dr. Nyström and Dr. Fries, assisted in making collections on shore. We found but twenty specimens of Arachnida, nearly all of them new to science. A few of them were also taken by Professor Nordenskiold in 1870. We collected a pretty good amount of skeletons and implements from some long-abandoned Esquimaux villages. Also temperature soundings were taken; and samples of water from the abysses of Baffin's Bay were brought home. I hope the expedition will prove to have many important results to science; only we want the means of employing scientific people to work it all out; but the Swedes have not copper enough to do such things rapidly.

This summer I have examined the greater depths in Skagerrack down to 355 fathoms, the greatest depth ever found in Skagerrack being a little more than 400 fathoms. Although I had not very long time for the explorations, I was very successful indeed. The most interesting haul during the cruise may be one in lat. 58° 35′ N., long. 10° 15′ E., depth 150 fathoms, bottom clay. Among other things, I got there two specimens of the rare Synaptoid *Olizotrochus vitreus.*

I suppose you know that the Swedish naturalists are never allowed to keep any specimens obtained in the expeditions fitted out by the government; all belong to the Royal Museum of the Vetenskaps Akademien; and thus I have no right whatever to make a bargain with the animals that I collected in Greenland.

I am very much obliged to you for your kindness in sending me the catalogue.

Report on a Memoir by Dr. Dufossé, " On the Noises and Expressive Sounds which the Freshwater and Marine Fishes of Europe produce." By M. C. Robin.

The memoir submitted to our examination is a considerable work, a true monograph; it has cost its author numerous investigations. This subject has been, on his part, the object of very diverse observations, the summary of which has on several occasions been inserted in the 'Comptes Rendus.'

The first part of Dr. Dufossé's work consists of a very extended history, summing up all that naturalists and physiologists have said with regard to the noises produced by certain fishes. This history commences with Aristotle, whose remarks upon this question deserve to be recalled.

" Fishes," he says, " having neither lung, nor trachea, nor pharynx, have no voice. Those which have been said to have one, produce nothing but certain sounds and whistlings. Such is the kind of grunting of the *Lyre*, the *Chromis*, and the fish called the *boar*-fish, which is found in the Acheloüs. We may also cite the *Chalcis* and the *cuckoo*-fish: the former makes a sort of whistling; the second emits a sound approaching that of the bird whose name it has received in consequence of this resemblance. All these fishes produce what has been called *their voice* either by the rubbing of their branchiæ, which they have garnished with points, or by means of certain internal parts near the intestine, and which contain air. It is this air the agitation and friction of which produce a sound. Some Selachii also seem to whistle. All this, however, can only improperly be called *voice*; we must say that it is a sound." (Hist. Anim. Lib. iv., Camus's translation, Paris, 1783, tom. i. p. 221.)

The sounds emitted by fishes may be very varied *irregular noises*, such as those which the *Cyprini*, the loaches, the *Dactylopteri*, the *Hippocampi* and others produce with their lips or their opercula, or by moving certain articulations.

There are other, *regular noises*: various Scomberoidei produce these by the friction of the pharyngeal bones; the *Orthagorisci* cause them by the friction of their intermaxillary teeth; various Cyprinoidei, Anguilliformes, Siluroidei, &c. cause them by expelling into the œsophagus the air of their swimming-bladder.

Lastly, there are noises which, while *regular* and *voluntary*, like the preceding, result from certain peculiarities presented by muscles in course of contraction in fishes furnished with an air-bladder which has no communication with the œsophagus. These have been observed in *Peristedion cataphracta*, *Trigla*, *Sciæna*, *Zeus*, *Umbrina cirrhosa*, and *Hippocampus brevirostris*.

The mechanism of the production of the first two varieties of these sounds was already pretty well known; but M. Dufossé, by a fresh examination and by his dissections, has given more precision to several of the anatomical and physiological notions relating to it. This part of his investigations, which is already old, has, moreover, been the subject of a favourable report from our regretted colleague, Constant Duméril (see 'Comptes Rendus,' 1858, tome xlvi. p. 610). Therefore we will dwell only upon the later communications of the author, made from 1858 to 1862 (Comptes Rendus, 1862, tome lxiv. p. 393), which appear to us to be still more valuable than the preceding ones.

He has set himself to show, that the *regular sounds* which fishes emit may be voluntarily produced, and are not a simple consequence of some other physiological action. They are consequently, in certain cases, true acts of expression, however rudimentary.

M. Dufossé has shown that in the fishes which voluntarily produce regular sounds, these are commensurable as musical sounds; and although they are more imperfect than those emitted by serpents, as Lacépède had already remarked, he has determined their note in all the species which he has observed. He has also shown, by conclusive experiments, that all the fishes which emit noises or regular expressive sounds in the air, produce them also in the water—that is to say, in the medium in which they live and are naturally in relation to each other.

In the case of several species, the intensity of the sounds is so great that, when produced by a single individual, they may be heard at a distance of several metres; this is the case with certain *Triglæ*, *Zeus*, and especially *Pogonias chromis*, &c. When emitted by animals combined in shoals, they may be transmitted still further; more than once, under these conditions, they have frightened the crews of ships, who did not know to what cause to ascribe the noises produced around and beneath their vessels. They have been the source of more than one fable spread among maritime populations. M. Dufossé has himself ascertained the existence of these noises, by going frequently, and not always without danger, to pass whole nights on the open sea in fishing-boats.

In the case of the fishes with an air-bladder which does not communicate with the œsophagus, M. Dufossé has ascertained experimentally that the wall of this reservoir was affected by strong and frequent movements during the production of the sounds. He has thoroughly studied the nerves and muscles then in action. His vivisections, aided by touch and auscultation, proved to him absolutely *that the muscles themselves are the agents producing the vibrations from which the sounds formed originate* (*loc. cit.* 1862, p. 394). Since then a distinguished physiologist, M. Armand Moreau, by submitting the nerves which run to the air-bladder of the gurnards to the action of an electric current, has ascertained that the striated muscles of the air-bladder contract and cause the reproduction of the characteristic sounds, and this in the animal when killed by section of the spinal cord (Comptes Rendus, 1864, tome lix. p. 437).

This mode of formation of sounds by contraction of the muscles of the air-bladder was not known before the investigations of M. Dufossé. Science has to thank him for this discovery, and for the care which he has taken in observing the diversities of this phenomenon from species to species of the fishes which present it.

We shall conclude this report by calling the attention of the Academy to another point in this work, because it will certainly become the subject of fresh experiments made by means of the registering and other instruments which now-a-days serve to determine the real nature of a great number of organic phenomena. According to M. Dufossé, it is not the readily visible movements of the air-bladder that are the cause of the sound heard while they last. Although much greater than the concomitant trepidations which cause the sonorous vibrations, these contractions merely tighten or relax certain parts of the air-reservoir; and the use of the latter in this respect is to act as a sounding-board, an organ for the reinforcement of the sounds produced, which are comprised between *si*^{2} and *ré*^{5}.

It is well known that the striated muscles during contraction give rise to a peculiar sound, which is called the *muscular sound*, *rotatory sound*, *susurrus*, *wrinkling*, or *myophonia*, and has been well studied by Wollaston, Erman, Gilbert, Laennec, and many modern observers. According to M. Marey this muscular sound corresponds sometimes to the *ut*, and sometimes to the *si* of the lower octave of the piano. Now, according to M. Dufossé, the noise produced by the fishes of which we are speaking is this very muscular sound, caused by the contraction of the voluntary muscles of the air-bladder; and the latter plays, with respect to it, the part of an organ of reinforcement in a sufficiently marked manner to enable it to reach our ears.

The Academy will see that, if the correctness of this ingenious analysis of the mechanism of production of the sounds produced by the air-bladder should be experimentally confirmed, the acoustic property of muscular contraction will be raised to the height of a phenomenon productive of sounds, not merely commensurable, but even expressive. In the absence of experiments made by your committee, it cannot yet pronounce a formal opinion upon this point. But it recognizes that, by the sagacious and laborious employment of his knowledge of comparative anatomy and physiology, M. Dufossé has discovered new facts which have elucidated several previously obscure ichthyological questions. — *Comptes Rendus*, November 4, 1872, tome lxxv. pp. 1074–1078.

On a new Species of Balænoptera. By Capt. C. M. SCAMMON, U.S.R.M.

BALÆNOPTERA, Gray,
P. Z. S. 1847, p. 89, B. M. Cat. Cet. 1850, p. 31.

Balænoptera Davidsoni, Scammon, n. sp.

Above dull black; body, pectoral and caudal fins white below, with a white band across the upper surface of the pectorals near their bases. Gular folds seventy in number, the interspaces having a pinkish cast, though the more prominent portions are of a milky white. Head pointed; dorsal fin small, falcate, placed two thirds the length of the body from the end of the beak; pectorals small, narrow, placed one third of the animal's length from the anterior extremity. Genitalia opening below and slightly behind the anterior edge of the dorsal fin. Baleen pure white; laminæ on each side 270 in number, the longest not exceeding 10 inches. Total length of animal 27 feet; pectorals 4 feet long, 13 inches wide; spiracles 3 feet 8 inches, pectorals 8 feet 6 inches, anterior edge of dorsal 15 feet 6 inches, and posterior edge of dorsal 18 feet behind the end of the beak; height of dorsal 10 inches; breadth of flukes, from point to point, 7 feet 6 inches, width of lobes of the same 25 inches; from the fork of the caudal fin to the anus 8 feet 4 inches, to opening of vagina 9½ feet; anterior end of snout to corner of mouth 4 feet 8 inches.

Distribution from Mexico to Behring Strait, on the west coast of America.

The specimen from which this description was taken was obtained in Admiralty Inlet, Washington Territory, October 1870. It was a female, and contained a fœtus five feet long—thus correcting the error of the whalers, who commonly regard this small species as the young of the "finback" of the coast. The skull has been deposited in the National Museum at Washington.

This species is evidently congeneric with the *Balænoptera rostrata* of the British-Museum Catalogue of 1850; and, while changes in nomenclature (more recent than those reported in the works of reference now accessible to me) may render it necessary to change the generic appellation at some future day, the one now used seems sufficient for purposes of description. In specific details, also, the present species is nearly allied to the *B. rostrata*, as far as descriptions will admit of instituting a comparison. I have dedicated the species to Prof. George Davidson, U. S. Coast Survey, and President of the Academy, as a testimony of respect for his scientific attainments, no less than as a personal token of appreciation of his efforts to assist in the advancement of the scientific interests of this coast.

A more detailed account of this animal and its habits, accompanied by illustrations, is reserved for a monograph on the Cetaceans of this coast, which I have long contemplated, and which is now on the point of publication.—*Proceedings of the Cal. Academy of Sciences*, Oct. 4, 1872.

On the Varieties of Indris *and* Propithecus.

By Dr. J. E. Gray, F.R.S. &c.

A series of specimens of lemurs have arrived from Madagascar. The examination of them has confirmed the idea that I expressed in a paper sent to the Zoological Society, that these animals are liable to considerable variation, and that the presumed species of the genera *Indris* and *Propithecus* are mere varieties of colour.

The British Museum has lately received an adult *Indris*, which, instead of being black with a white patch on the hinder part of the back and a black tail, has a patch over each eyebrow, the fore legs nearly to the hands, the hinder part of the thighs, the legs from the knee to the ankle, and the whole of the underside iron-grey—that is to say, having a very large quantity of whitish hairs intermixed with the black ones; the ankles and hinder part of the heels white, and yellow below. The variety may be named *Indris variegatus*.

The British Museum has also received a fine adult specimen of the animal called *Propithecus diadema*, which differs from the three other specimens in the British Museum in having a greyish black instead of the white forehead that is to be found in the three other specimens.

On Peloric Structures. By Dr. Peyritsch.

In this paper, types of peloric structures in Labiatæ, Verbenaceæ, Scrophulariaceæ, and Ranunculaceæ were described in detail, and the peculiarities which each of these families presents in its peloric structures were discussed. With regard to the Labiatæ, the author endeavoured to show that the prevailing theory upon the structure of the Labiate flower is not tenable. Upon the hypothesis that with the first three whorls of flower-leaves an equal number of whorl-members must be assumed as originally present, the structure of the Labiate flower indicates changes which have taken place in the number of the flower-leaves. The prevailing theory explains the number of the anthers by the complete abortion of the fifth anther; but changes in the number of the whorl-members of the calyx and corolla may also have taken place, and the number of the anthers may indicate the original type.

The author expressed himself in favour of the latter alternative. The preponderant occurrence of quaternary types in the apical and lateral regular flowers is, in his opinion, in contradiction to the assumption of the quinary type. In zygomorphic flower-structures anomalies in the number of anthers often occur; but those are most rare in which a posterior anther appears. The assumption of a quaternary type has, moreover, the advantage of simplicity, and the number and position of the flower-leaves then stand in connexion with the position of the leaves and bracts, which only in the rarest cases depart from the cruciformly opposite position.—*Anzeiger der kais. Akad. der Wiss. in Wien*, October 24, 1872, p. 161.

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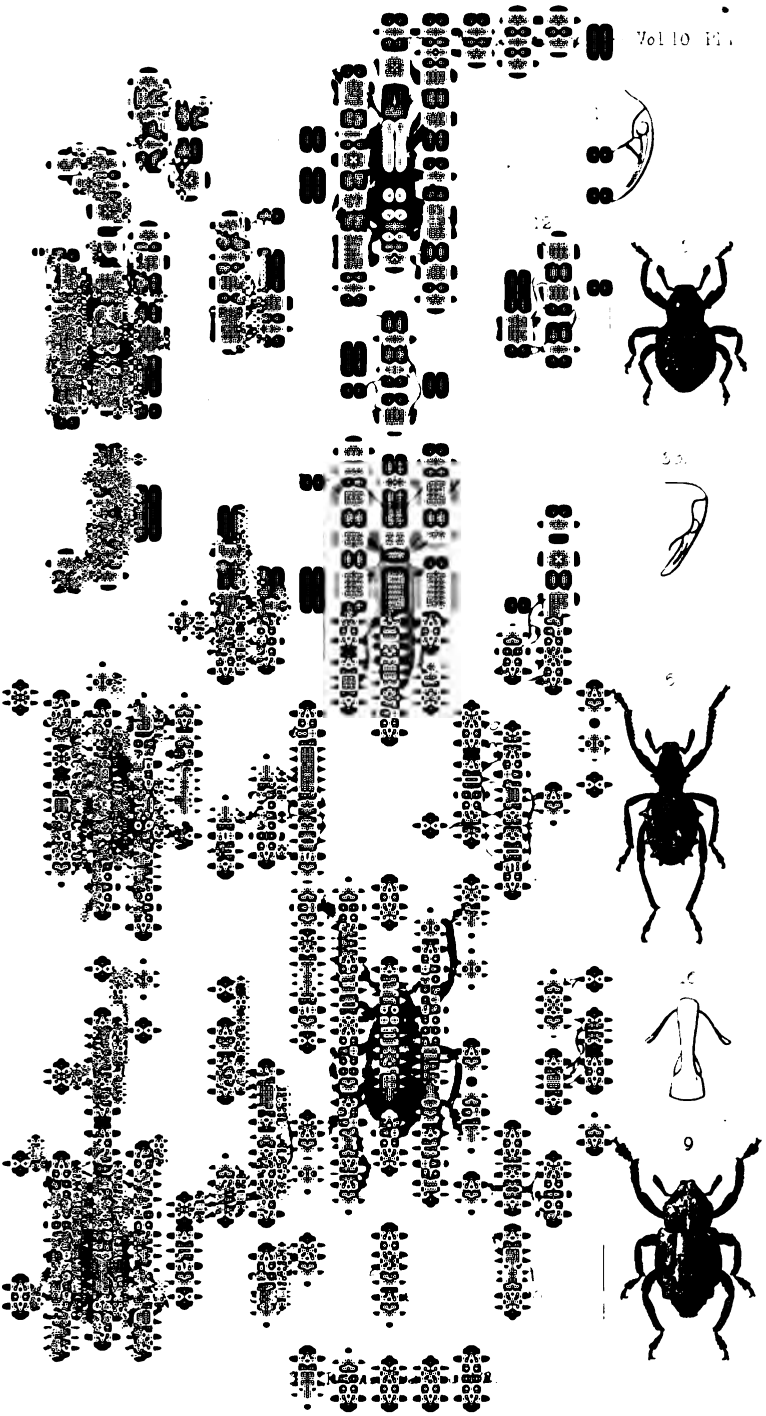
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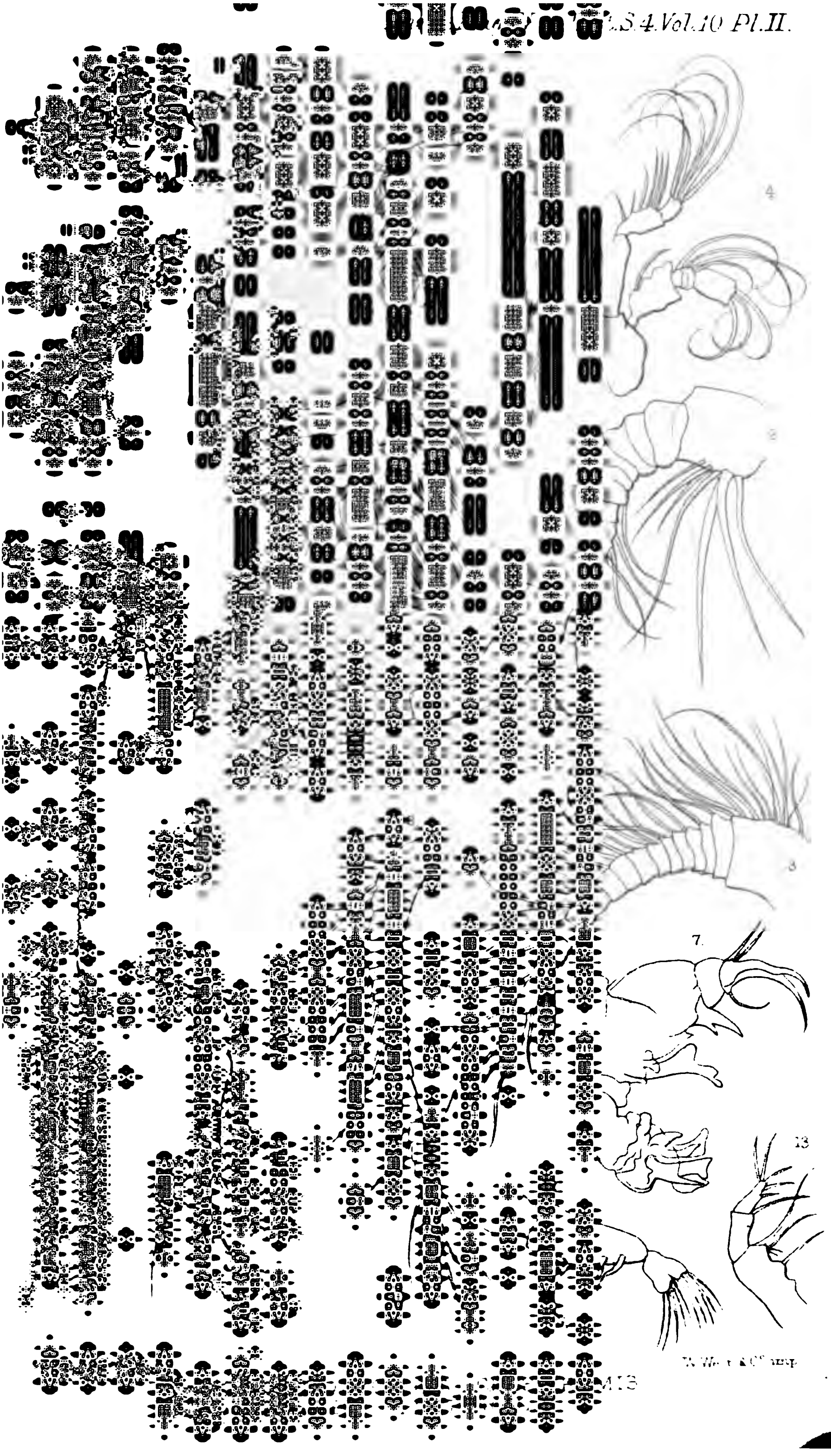

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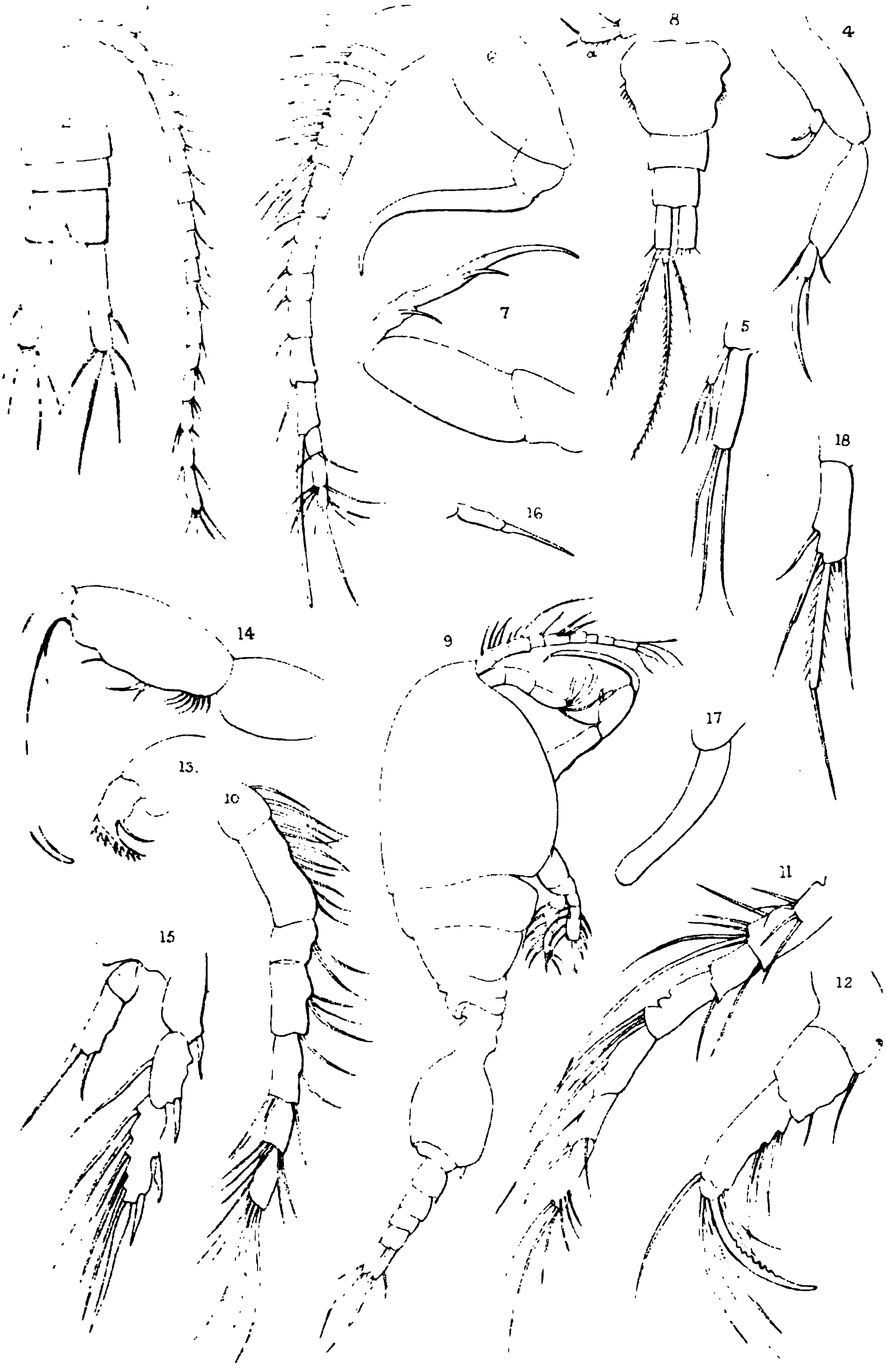

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1, 2 CYCLOPS OVALIS
3–8 CYCLOPICERA LATA
9–18 MACROCHEIRON FUCICOLUM

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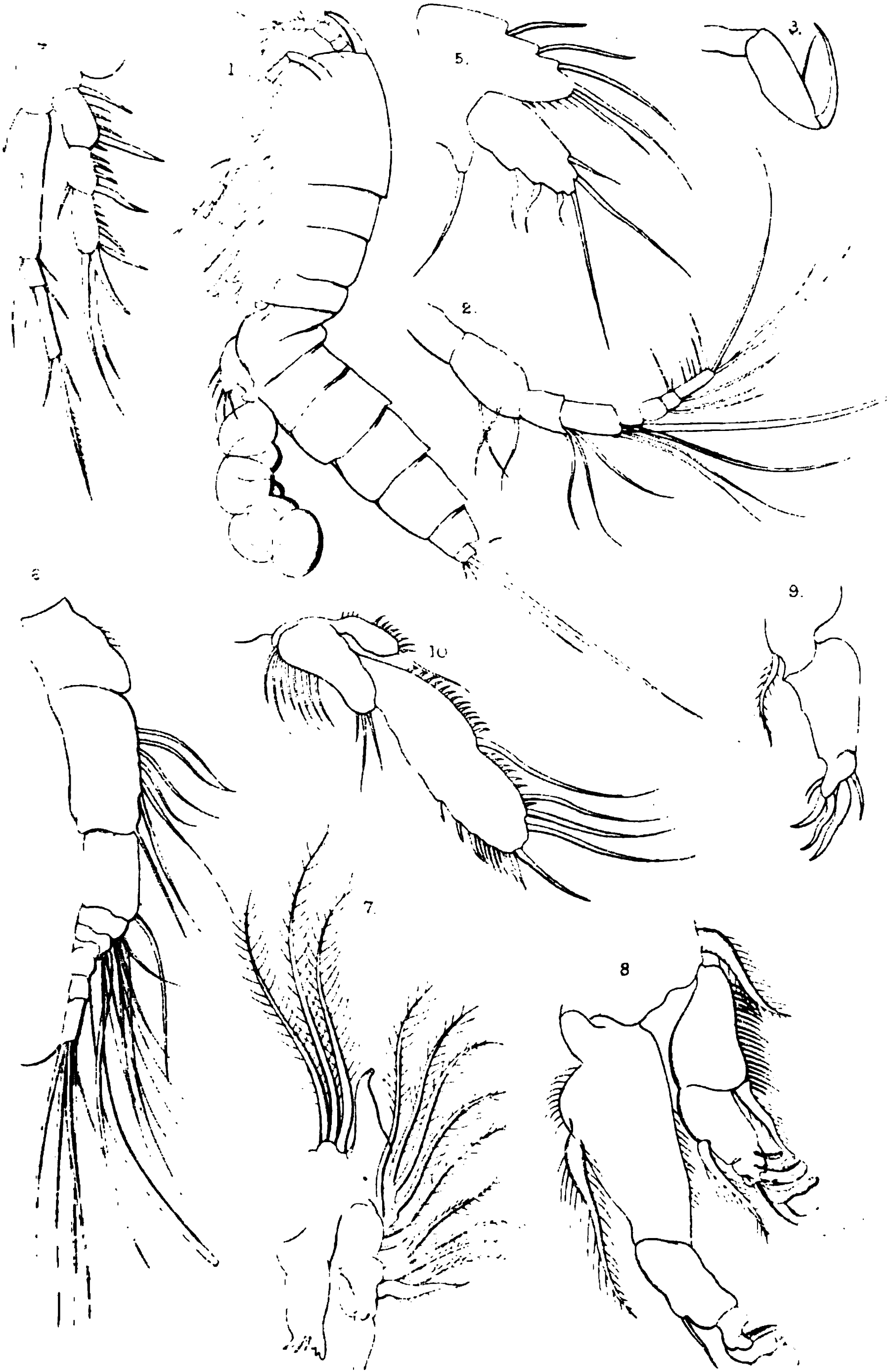

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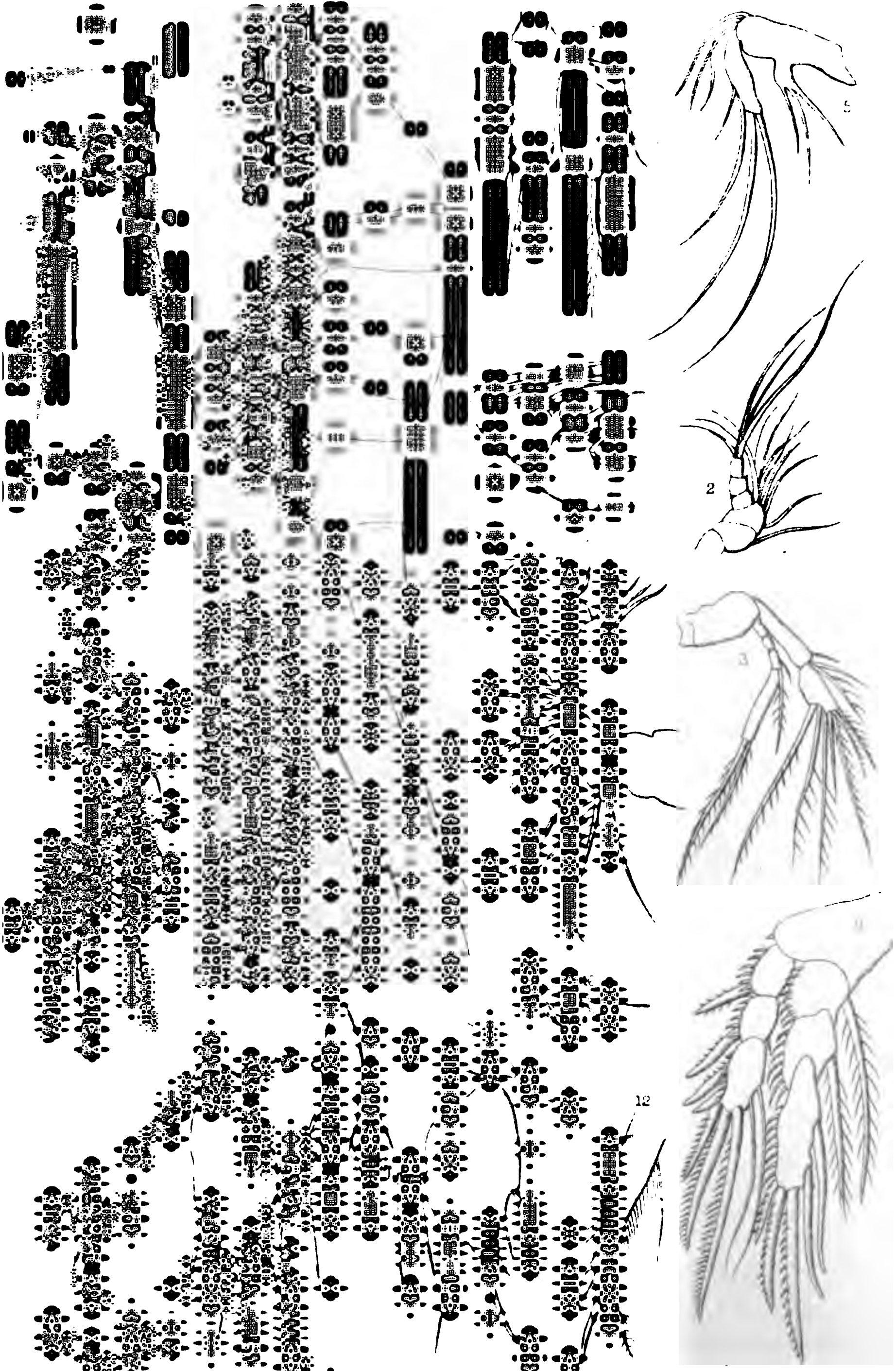
1–5. CANTHOCAMPTUS IMUS
6–10. SCUTELLIDIUM TISBOIDES



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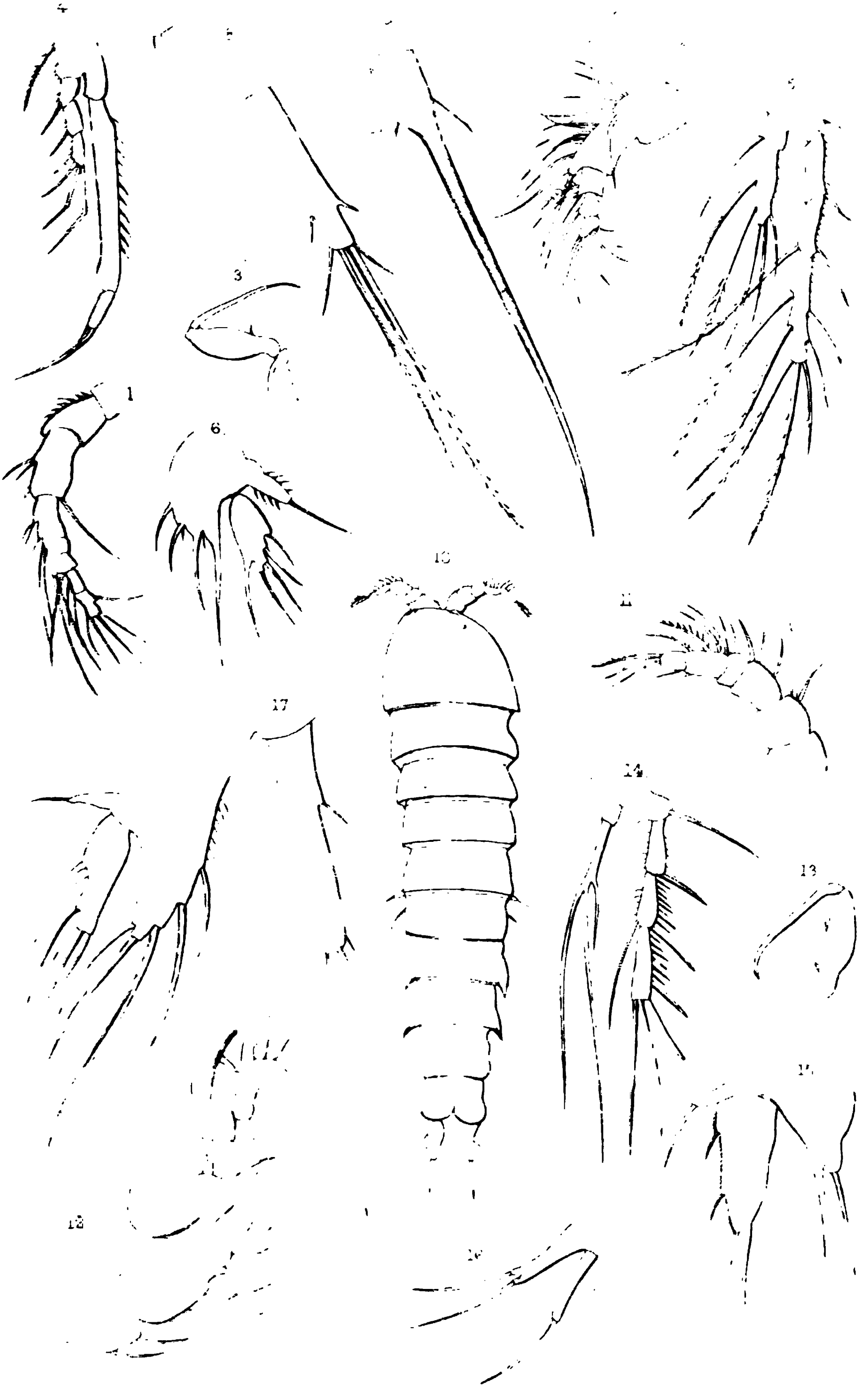

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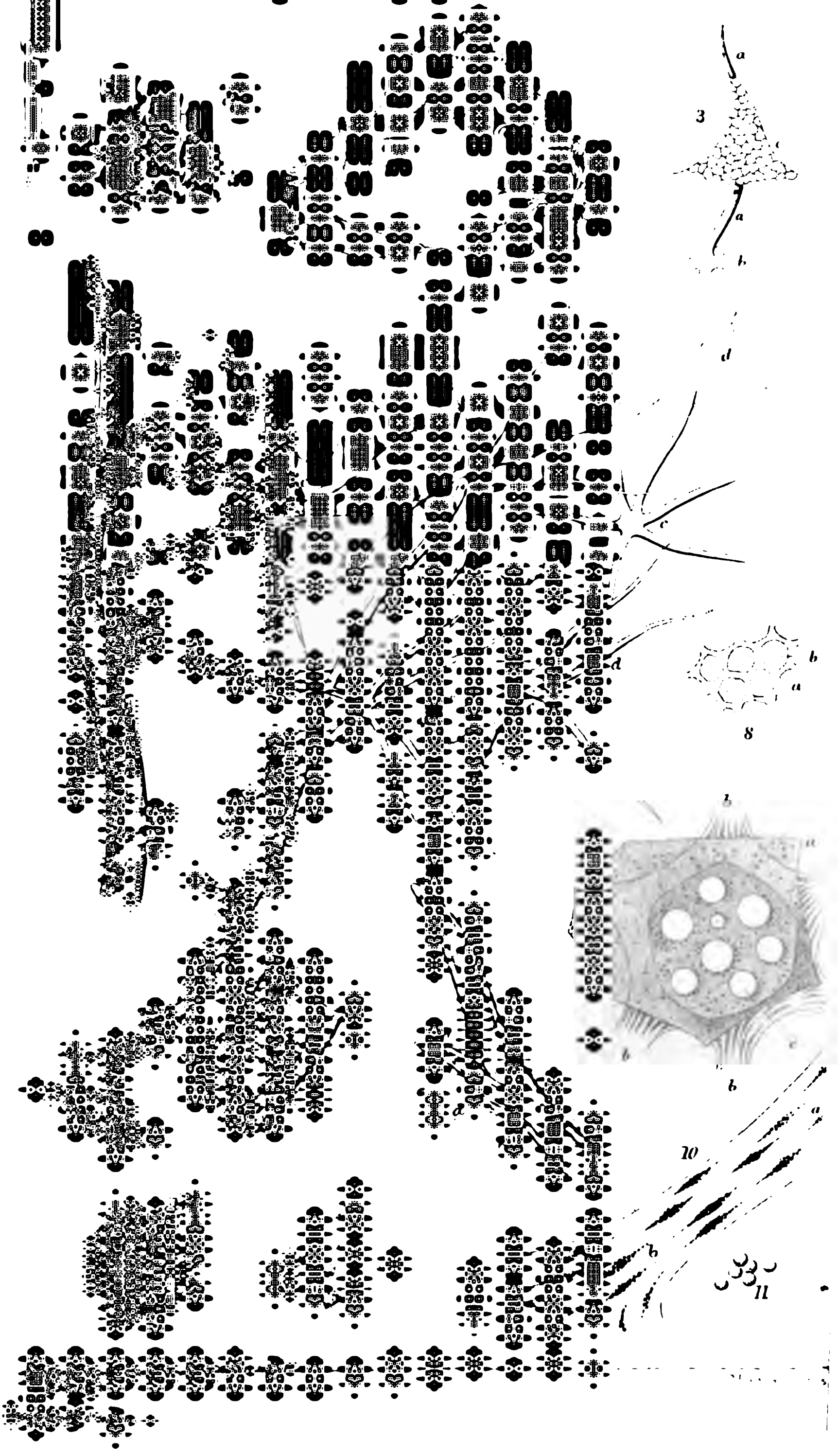
1–9 LAOPHONTE HORRIDA.
10–17 CLETODES LIMICOLA.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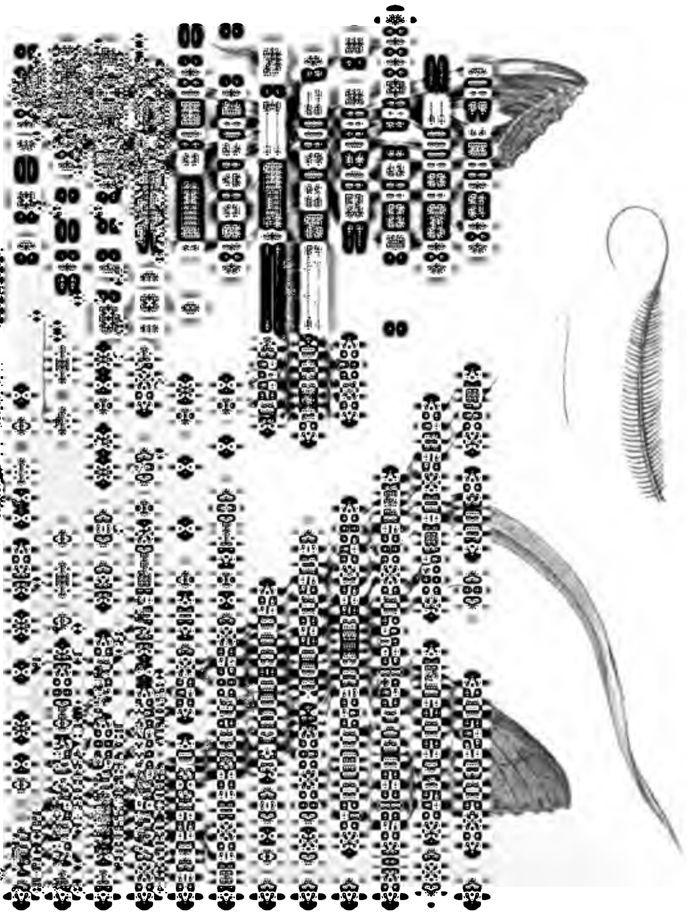

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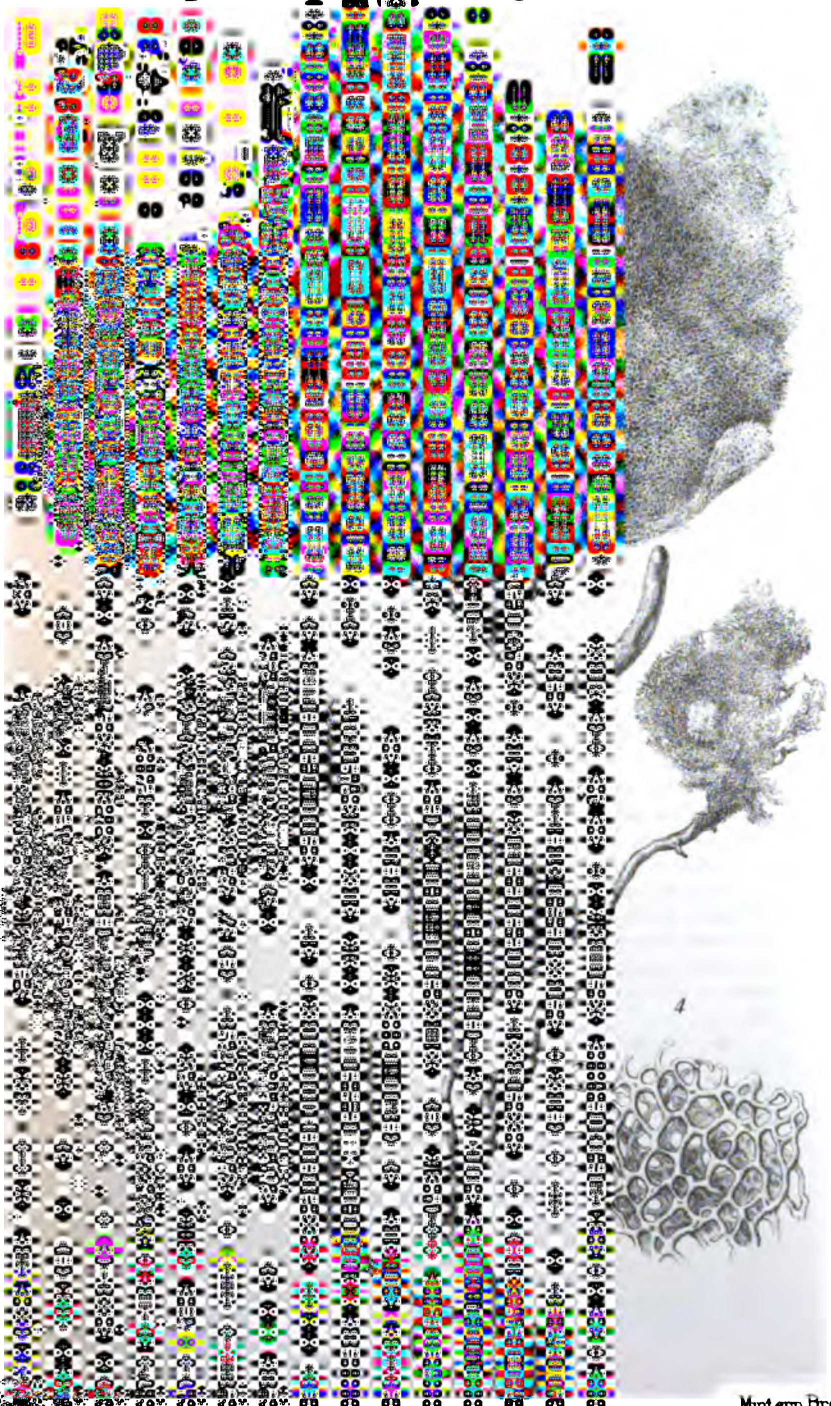

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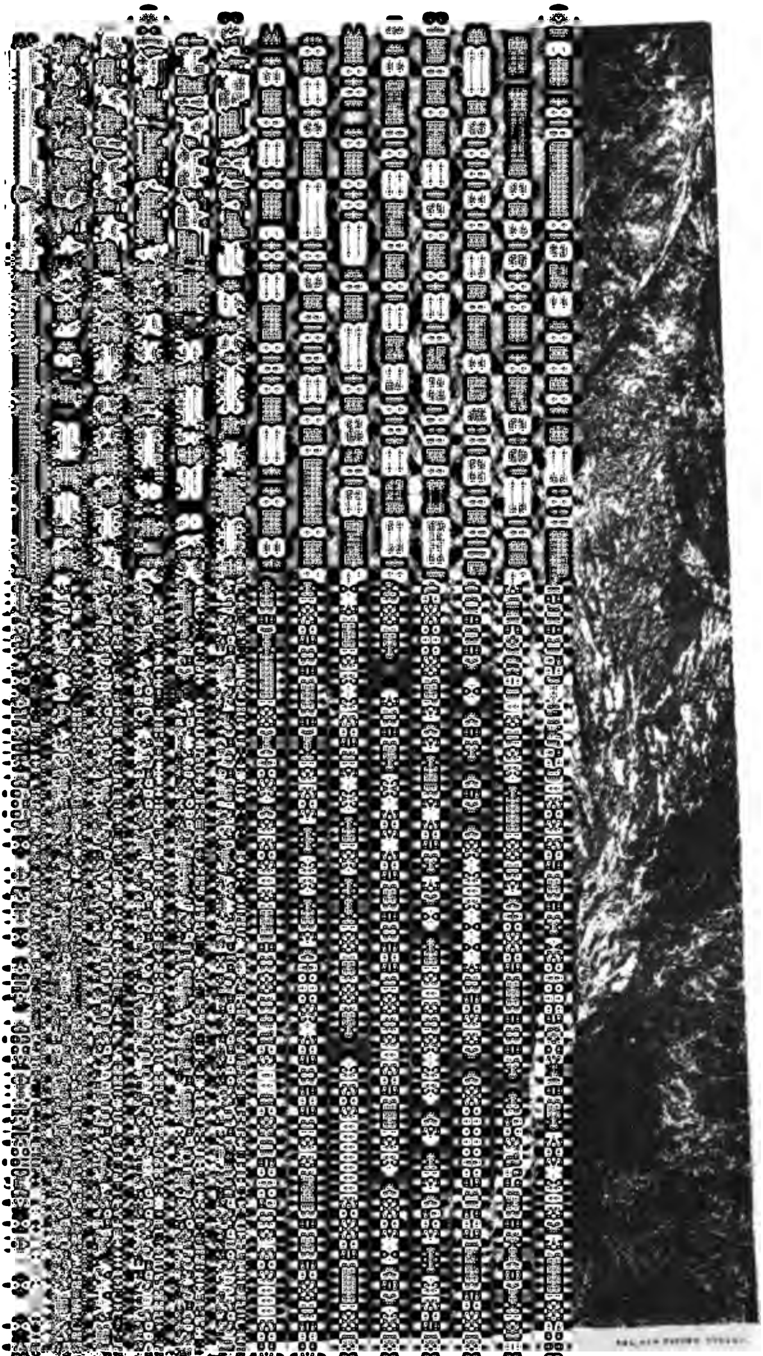

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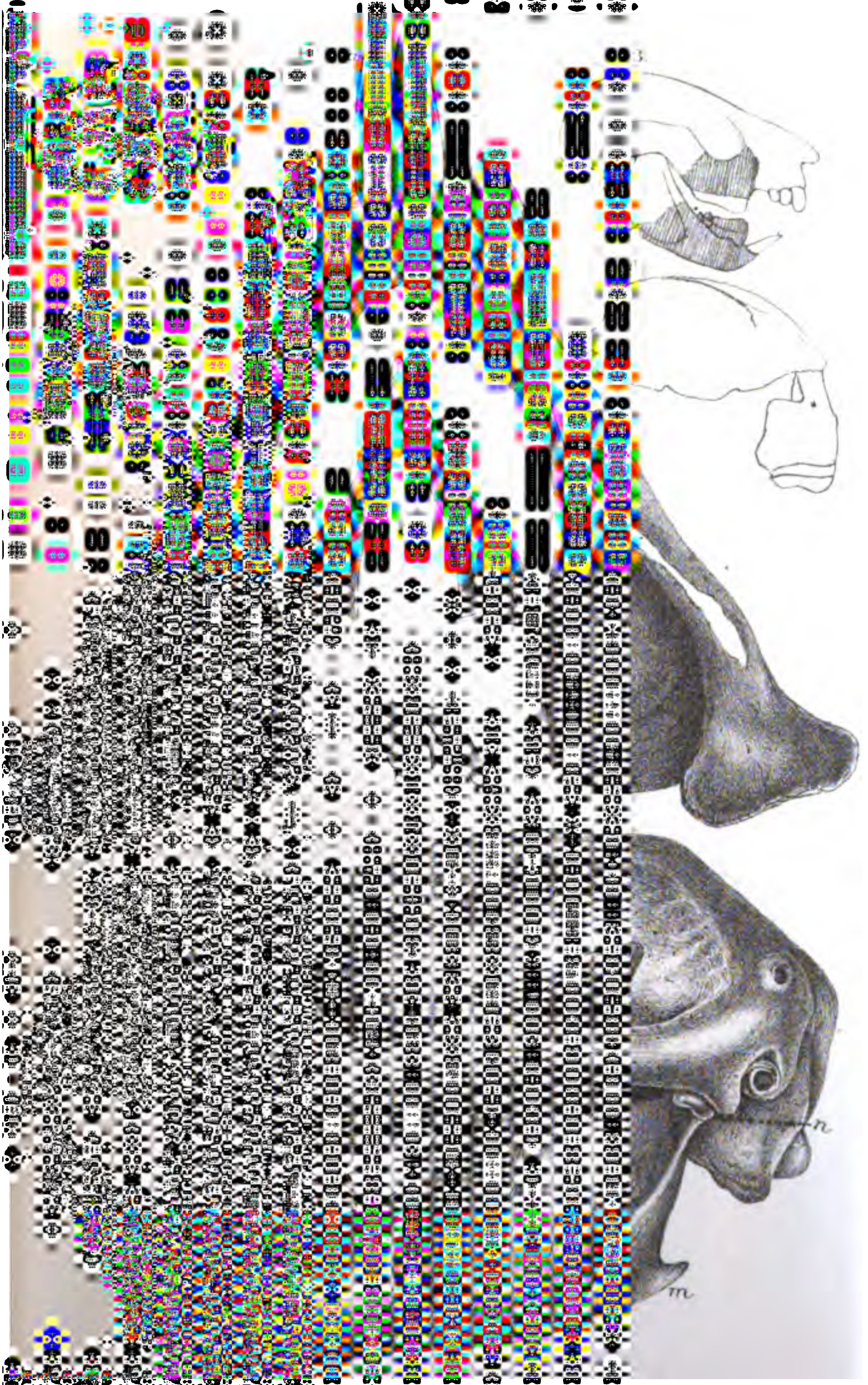

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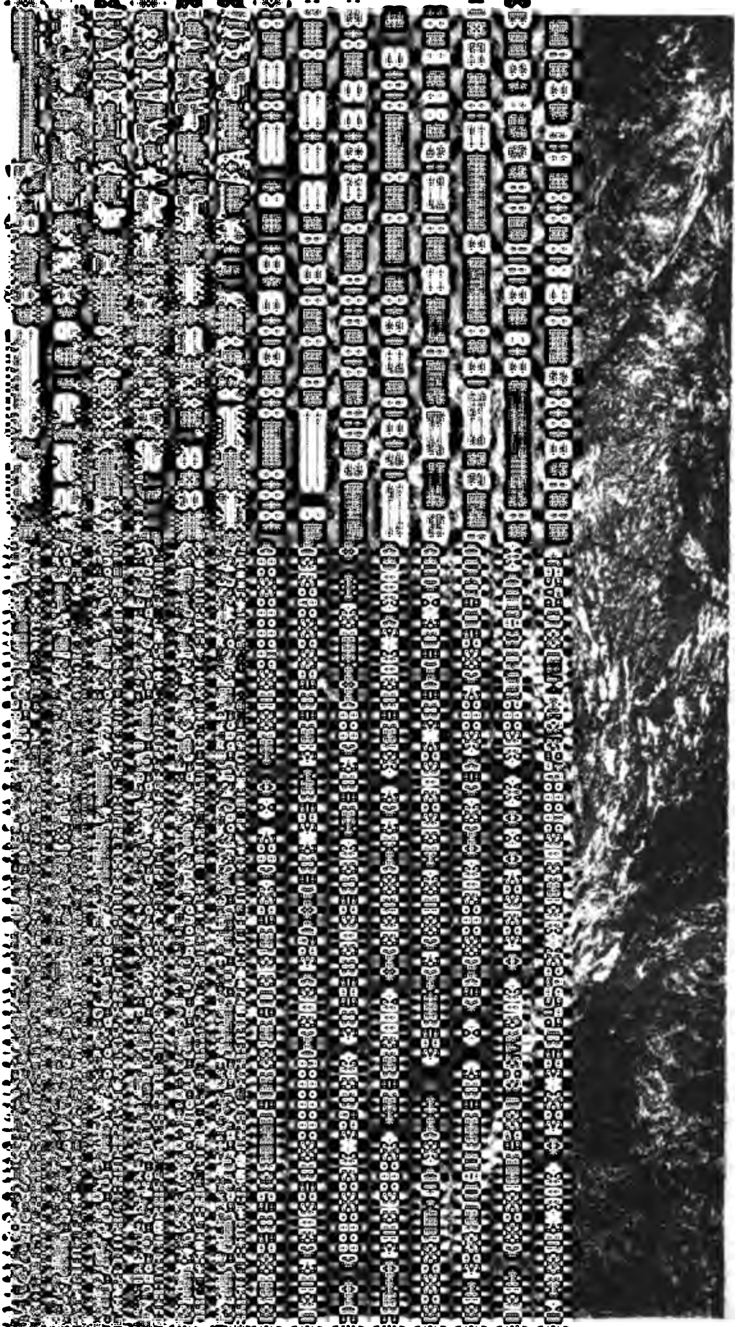

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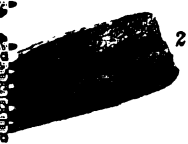
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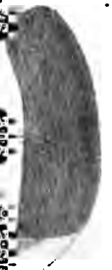

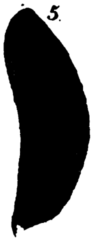
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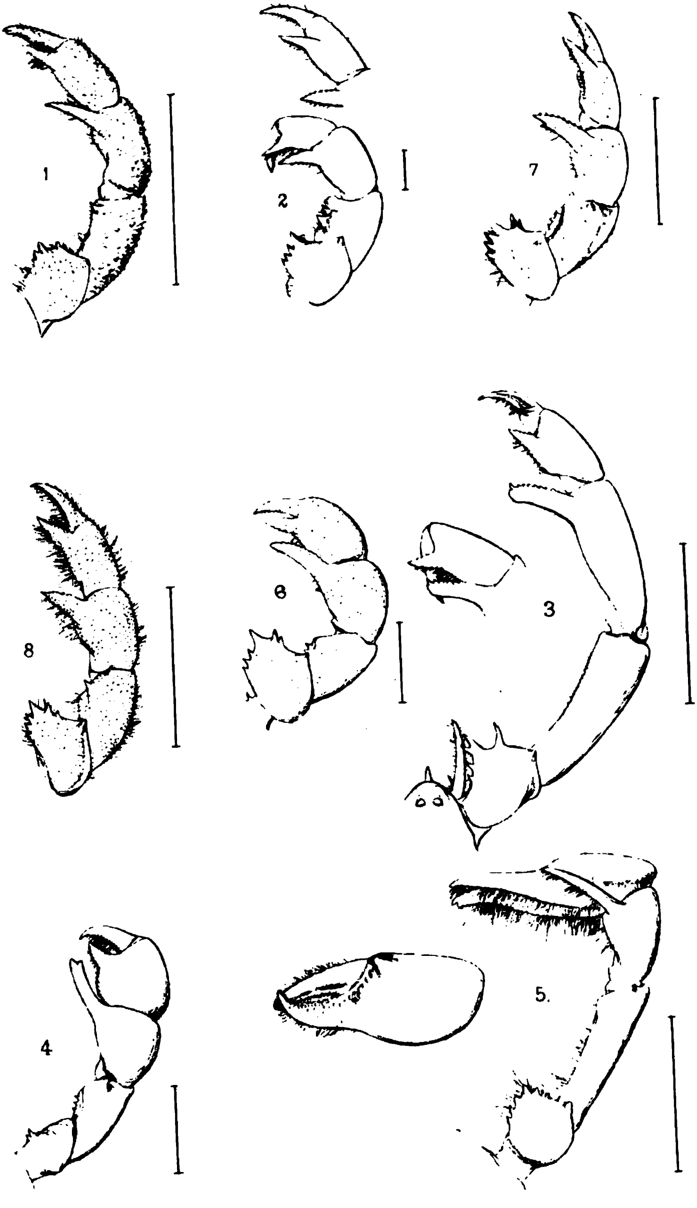

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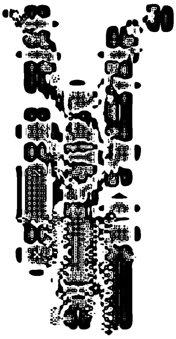

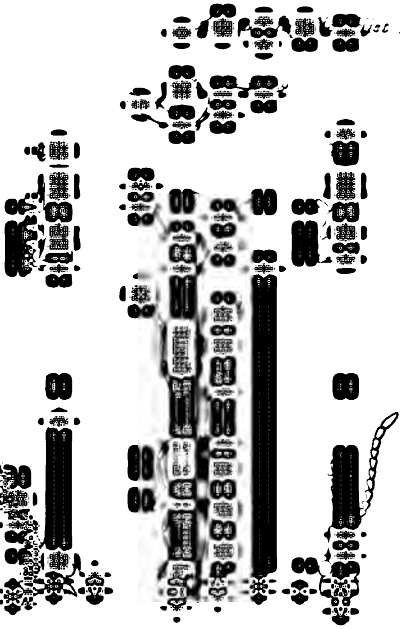

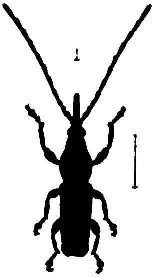

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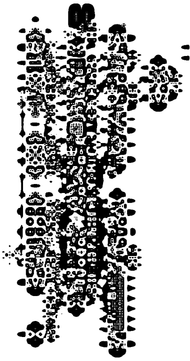

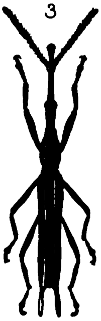

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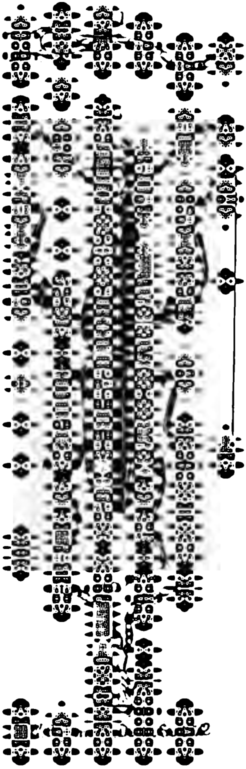

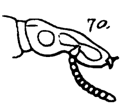

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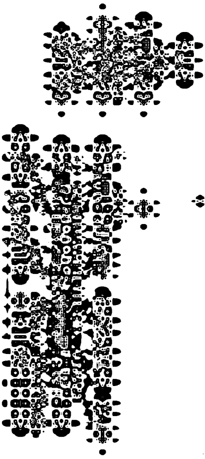

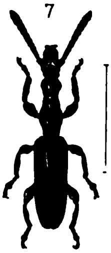

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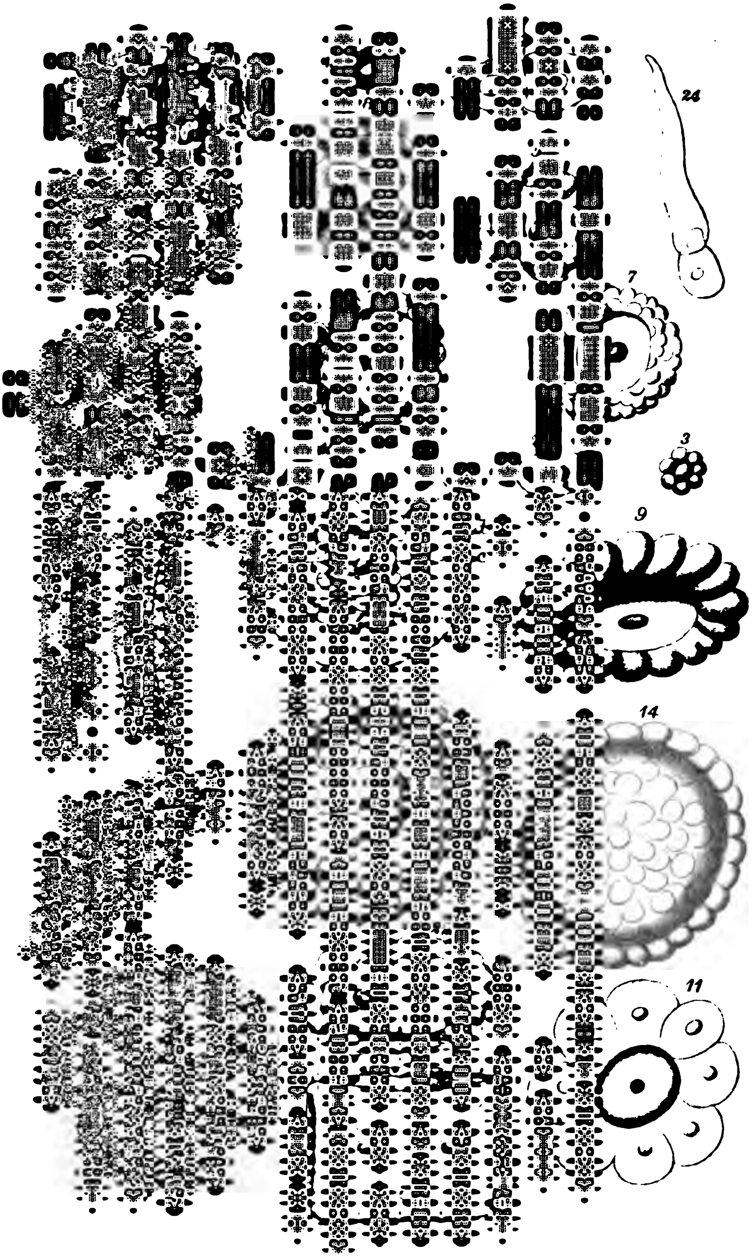

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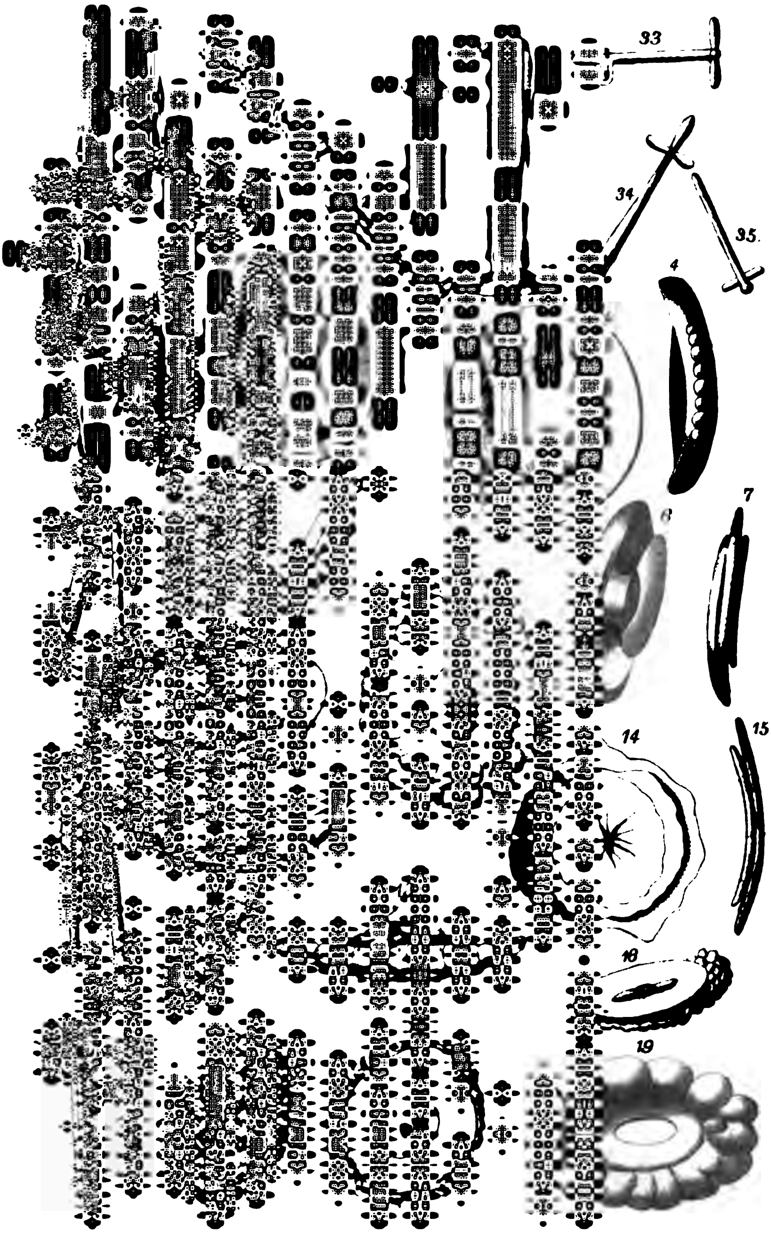

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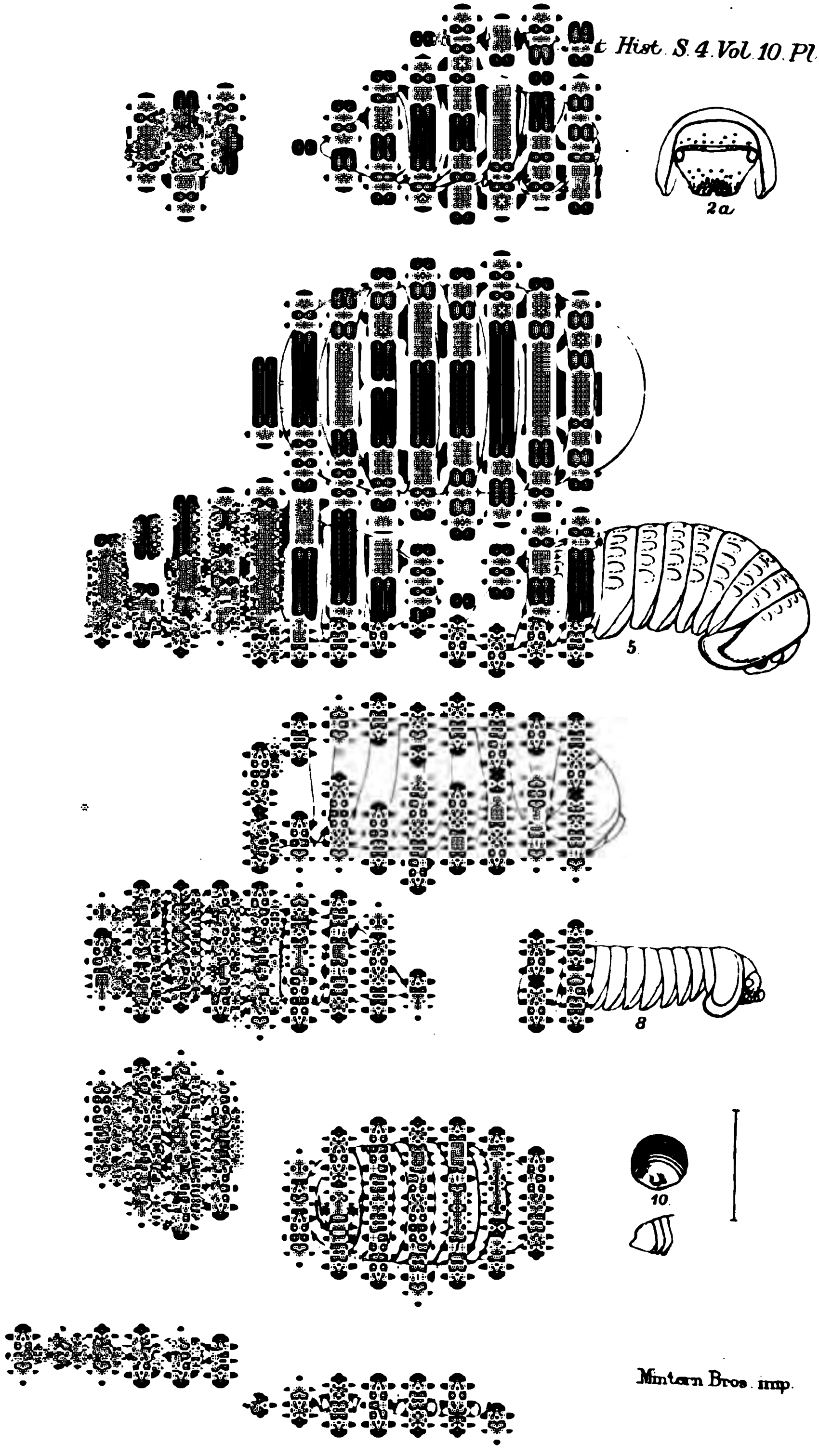

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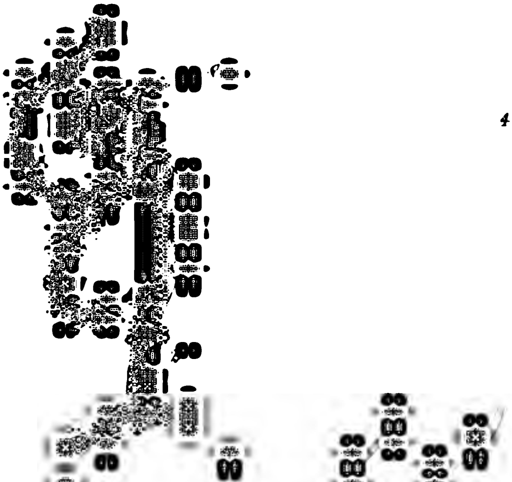

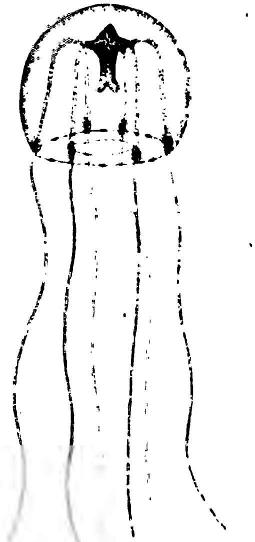
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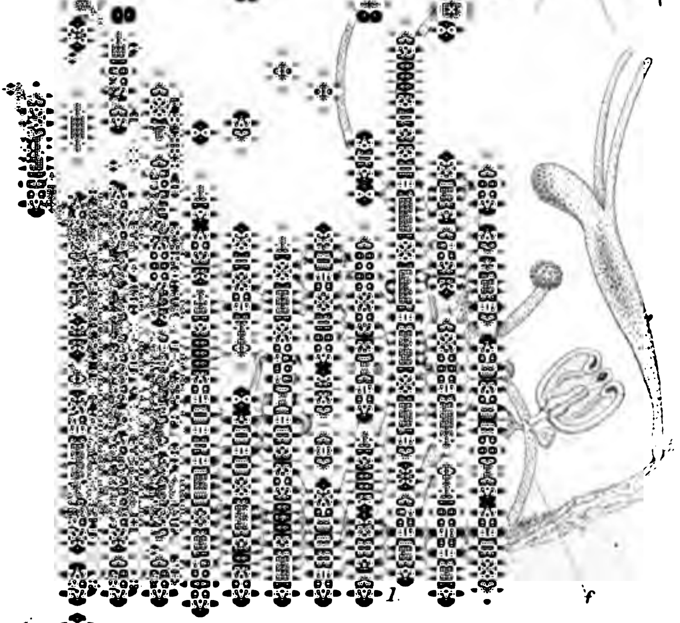

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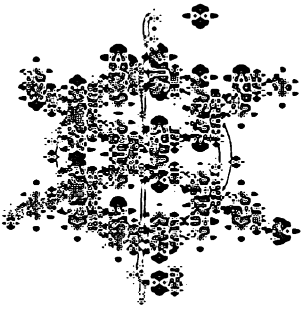

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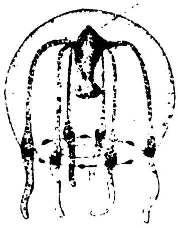

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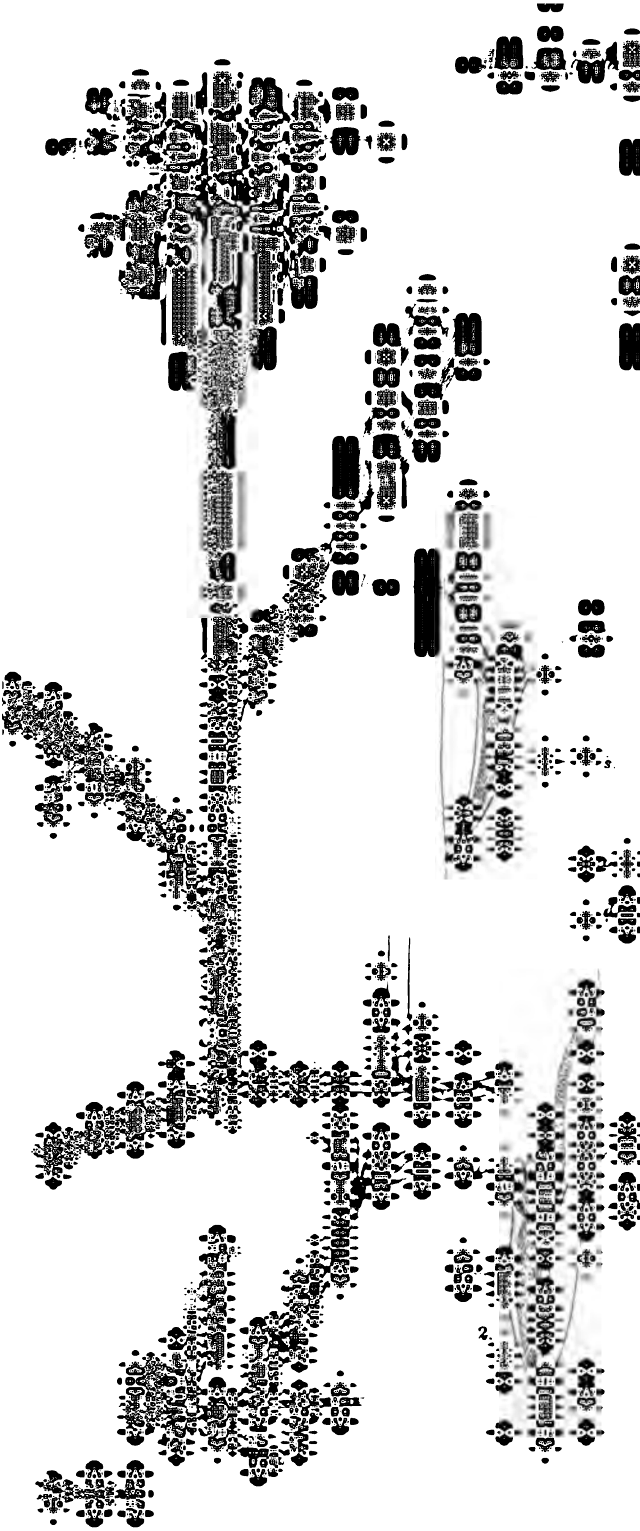

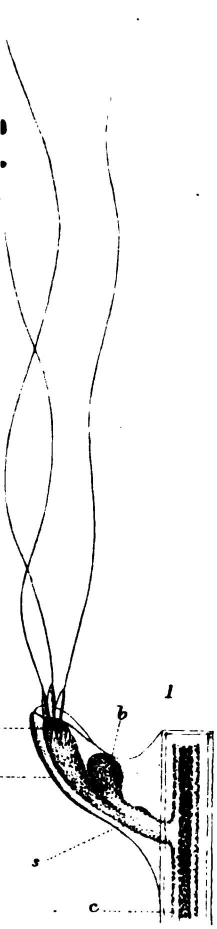

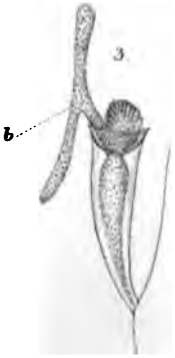

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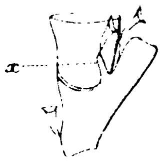

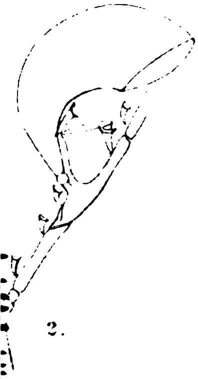

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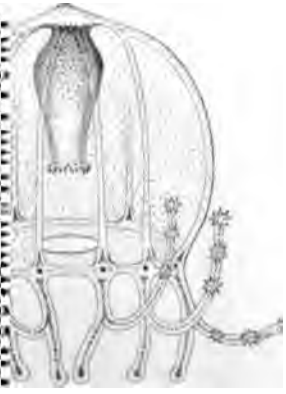

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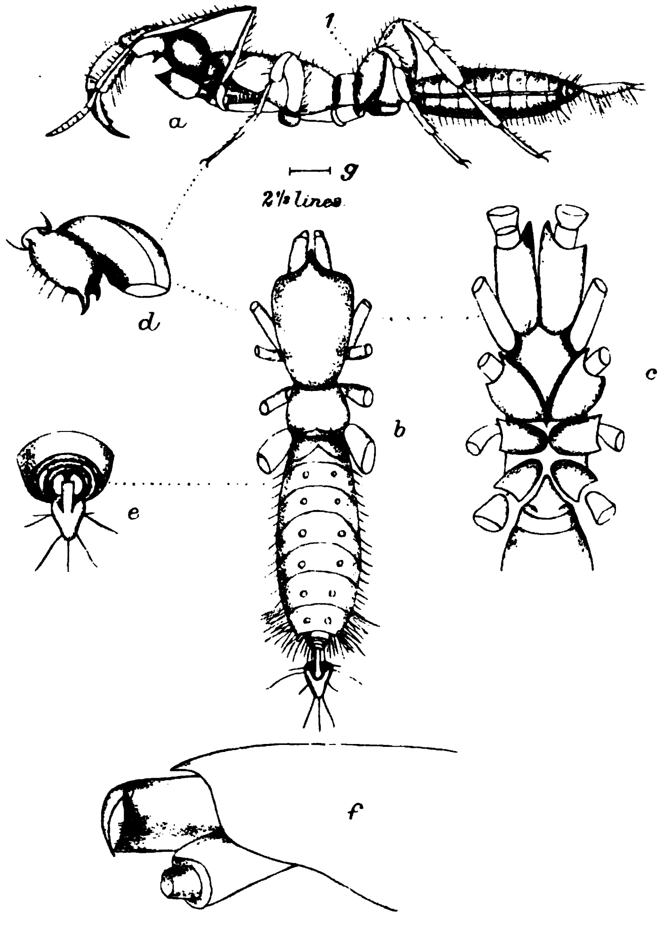

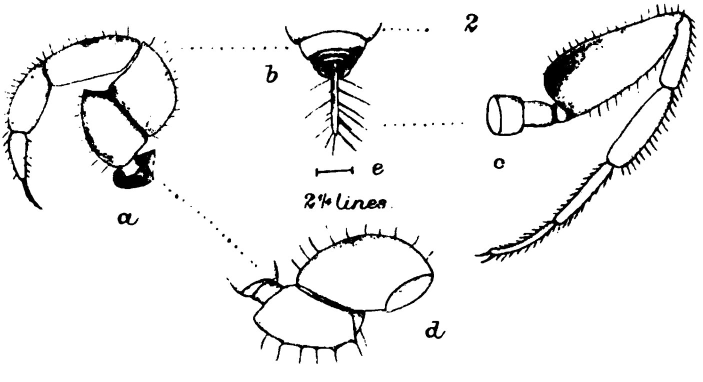

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